

## HAZARDOUS RANKING SYSTEM (HRS) DOCUMENTATION RECORD

### REVIEW COVER SHEET

**SITE NAME:** WEST COUNTY ROAD 112 GROUND WATER

**CONTACT PERSON:**

Documentation: Brenda Cook, USEPA  
Region 6 NPL Coordinator

214/665-8372

**Pathway, Components, or Threats Not Evaluated**

**Surface Water Pathway**

The Surface Water Pathway was not scored because the inclusion of this pathway would not significantly affect the Site score.

**Soil Exposure Pathway**

The Soil Exposure Pathway was not scored because the inclusion of this pathway would not significantly affect the Site score.

**Air Migration Pathway**

The Air Migration Pathway was not scored because the inclusion of this pathway would not significantly affect the Site score.

## HRS DOCUMENTATION RECORD

**Name of Site:** West County Road 112 Ground Water

**Date Prepared:** October 2010

**CERCLIS Site ID Number:** TXN 000 606 992

**Site Specific Identifier:** Unidentified Ground Water Plume

**Street Address of Site\*:** Intersection between County Road 112 and County Road 1205.

**City, County, State:** Midland, Midland County, Texas 79706

### **General Location in the State:**

The West County Road 112 Ground Water Site is located two blocks south of Interstate 20 (I-20) in the southwest quadrant of the I-20 and Cotton Flat Road intersection, outside and immediately to the southwest of the city limits of Midland (see Figure 1a for Regional Location Map, Figure 1b for Site Topographic Map, Figure 1c for Site Location and Surrounding Land Use Map, and Figure 1d for Ground Water Sample Location Map).

**Topographic Map:** U.S. Geological Survey 7.5 Minute Topographic Map, Southeast Midland Quadrangle. Photo revised 1995.

**Latitude:** 31.964129<sup>O</sup>

**Longitude:** -102.094921<sup>O</sup>

**EPA Region:** 6

\*The street address coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area in which the site is located. They represent one or more locations that the U.S. Environmental Protection Agency (EPA) considers to be part of the site based on the screening information EPA used to evaluate the site for National Priority List (NPL) listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA). Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

### **Pathway Scores:**

Ground Water Migration Pathway – 100.00

Surface Water Migration Pathway – NS

Soil Exposure Pathway – NS

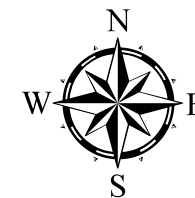
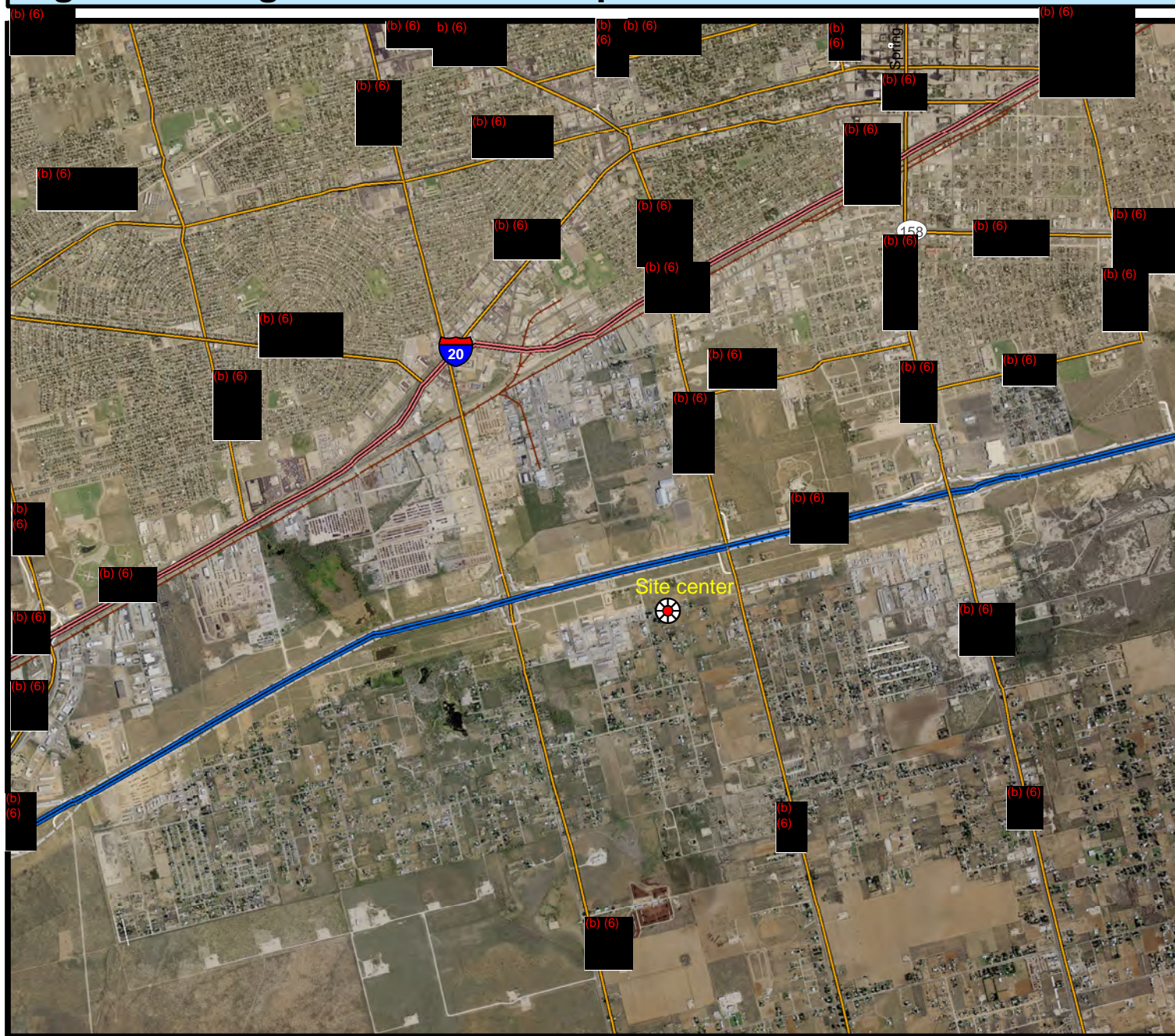
Air Migration Pathway – NS

\*\*NS = Not Scored

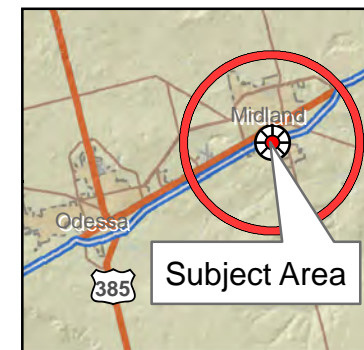
(\*\* Pathways were evaluated but not scored due to their minimal contribution to the overall site score)

<b>HRS SITE SCORE: 50.00</b>
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# Figure 1a: Regional Location Map

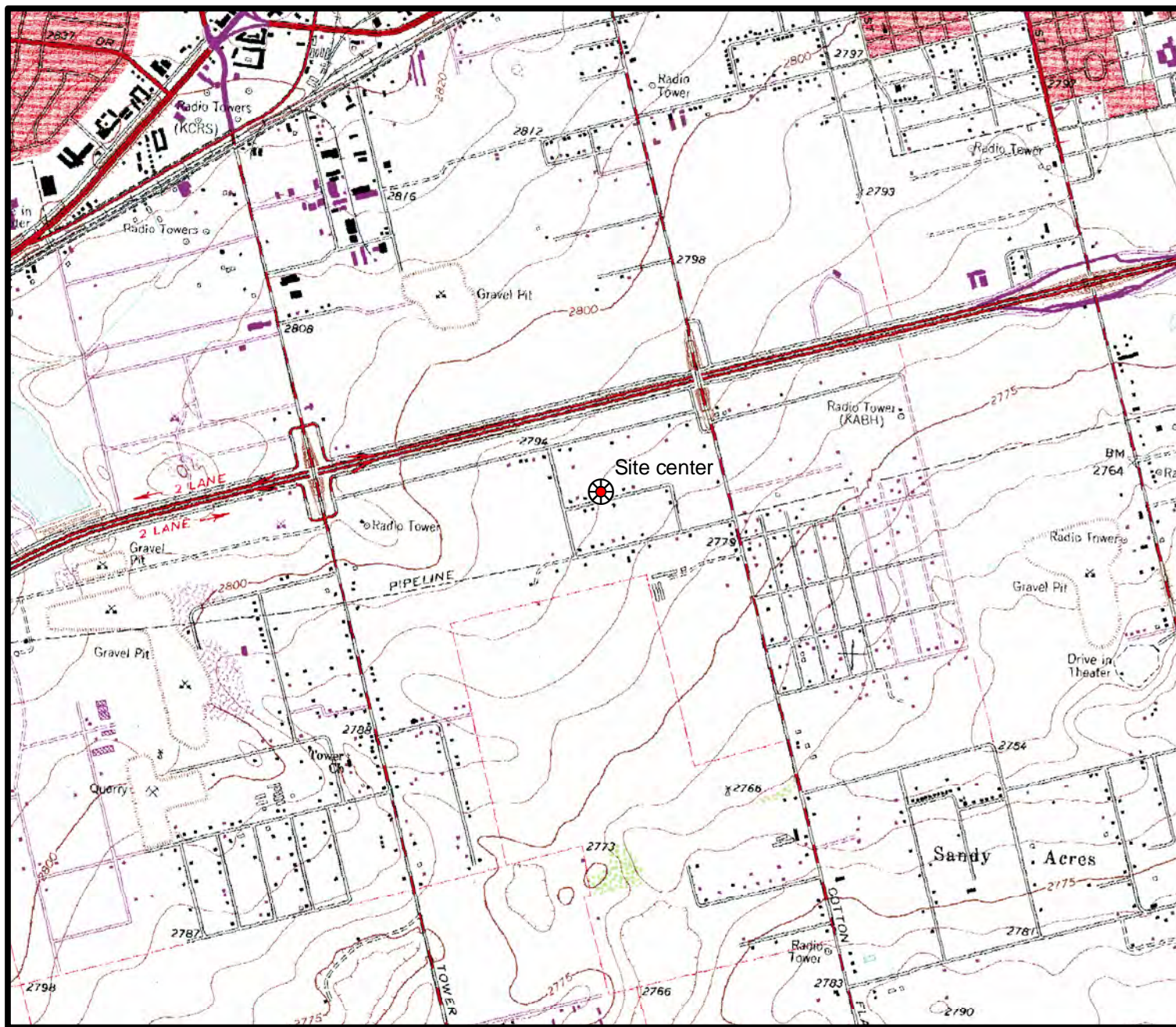


**West County Road 112  
Groundwater Plume  
Midland, Texas  
(Midland County)  
TXN000606992**



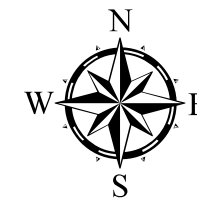
This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363.

**Figure 1b: Site Location Topographic Map**

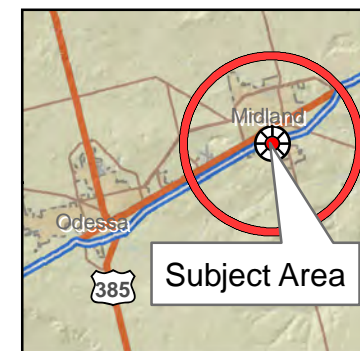


0 0.25 0.5 1 1.5 2 2.5 Miles

The base data set is U.S. Geological Survey 7.5 Minute Topographic Map, Southwest Midland Quadrangle. Available from Texas Natural Resources Information System (TNRIS), Data Search and Download.

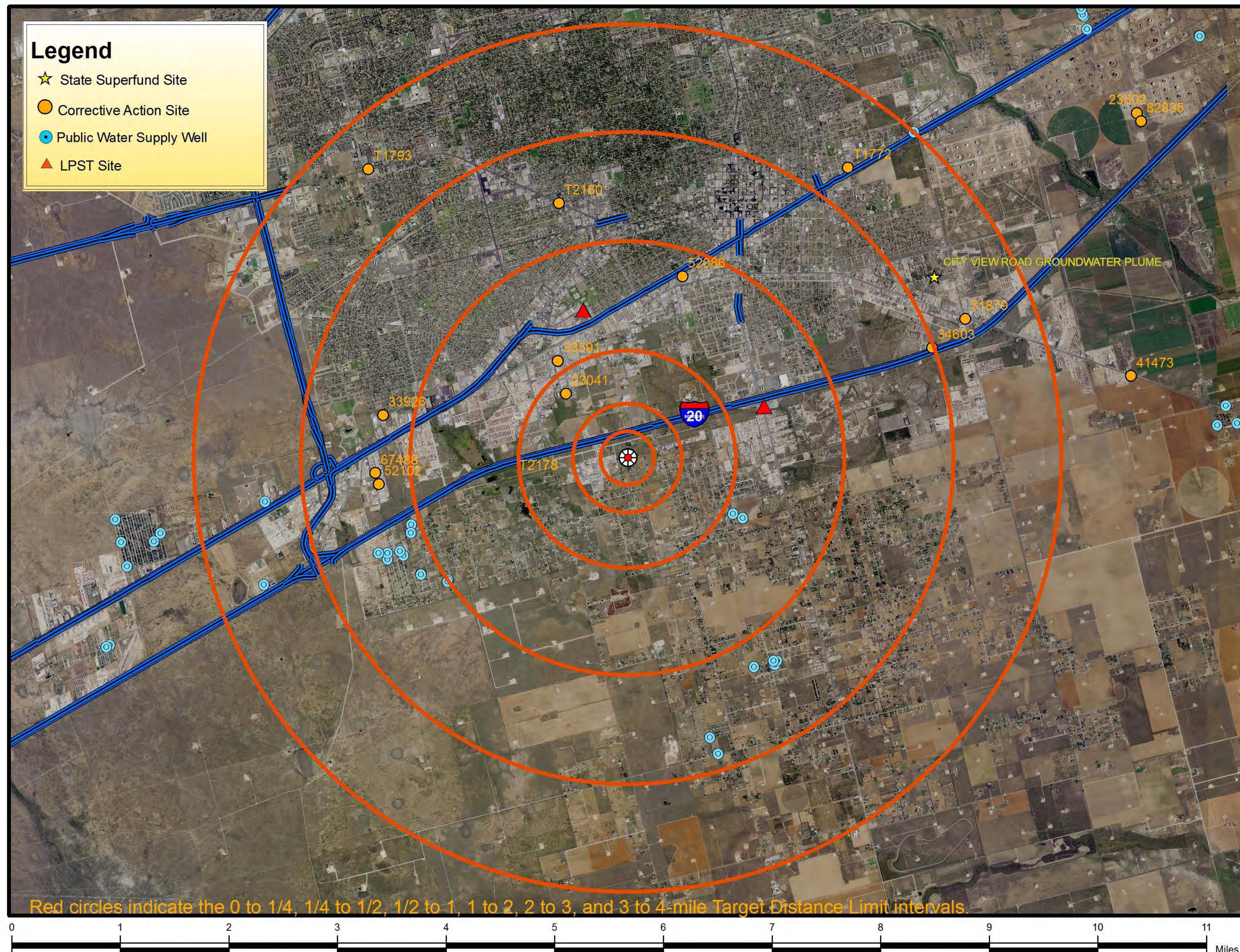


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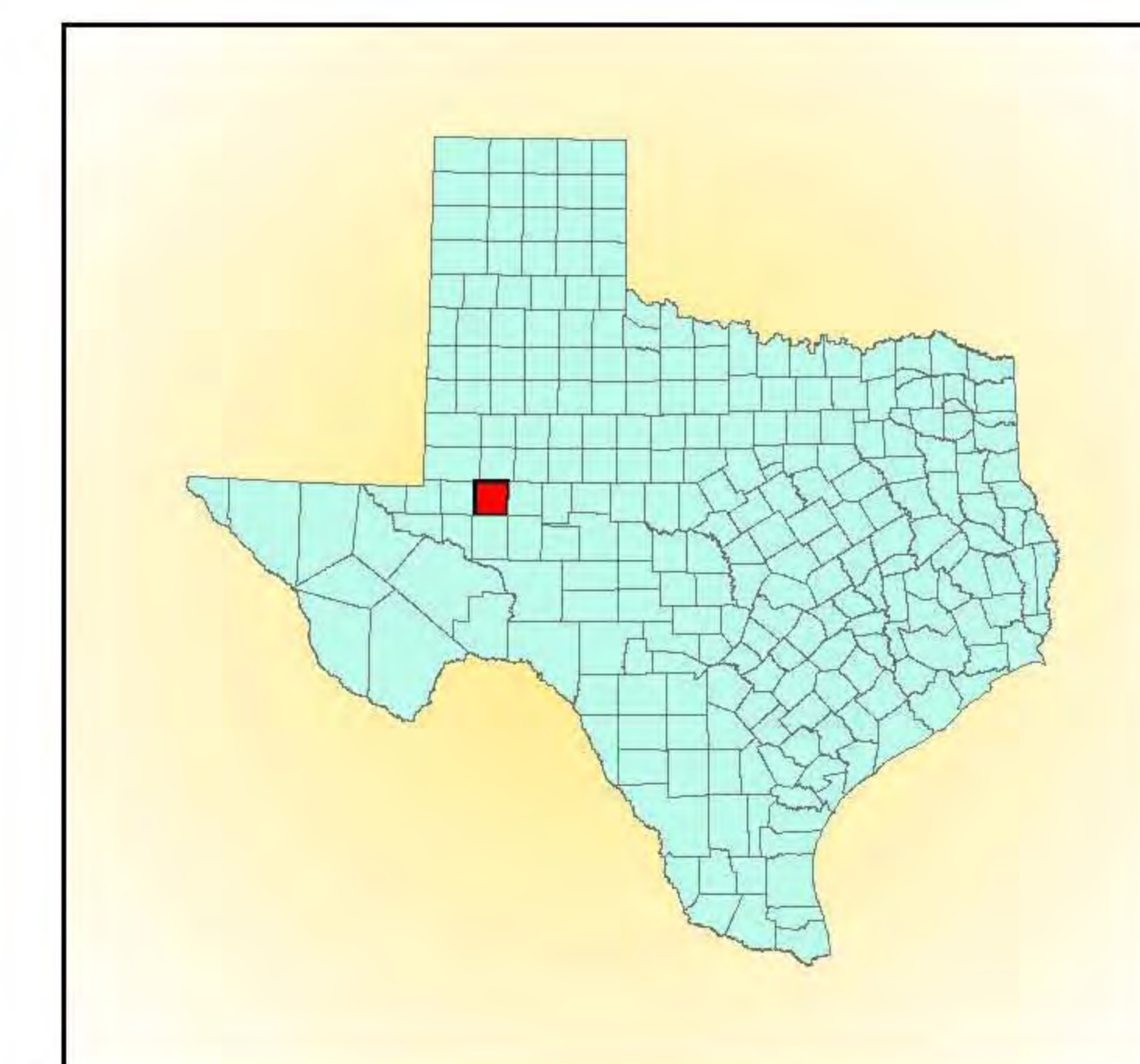
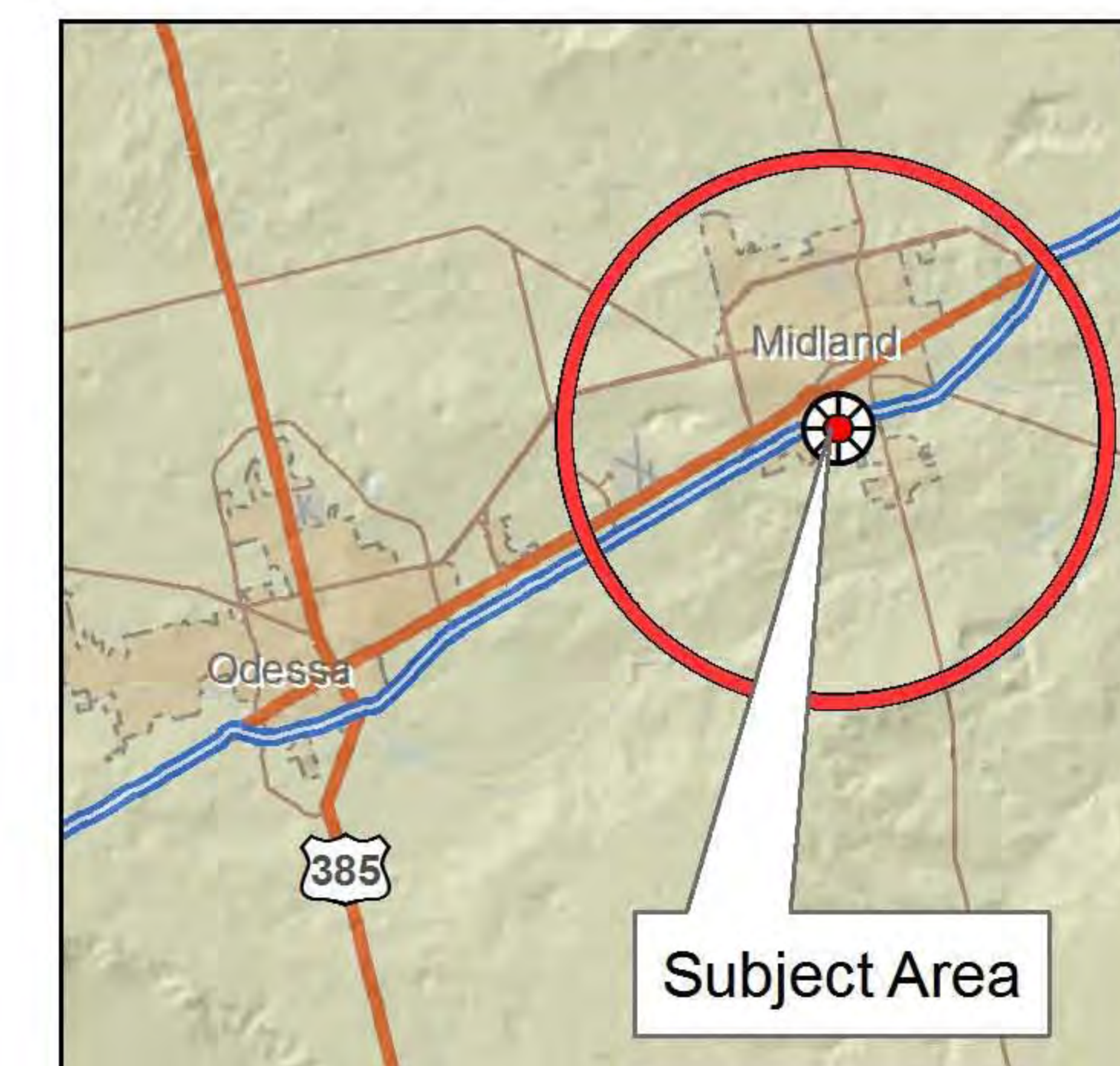


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# Figure 1c: Site Location and Surrounding Land Use Map

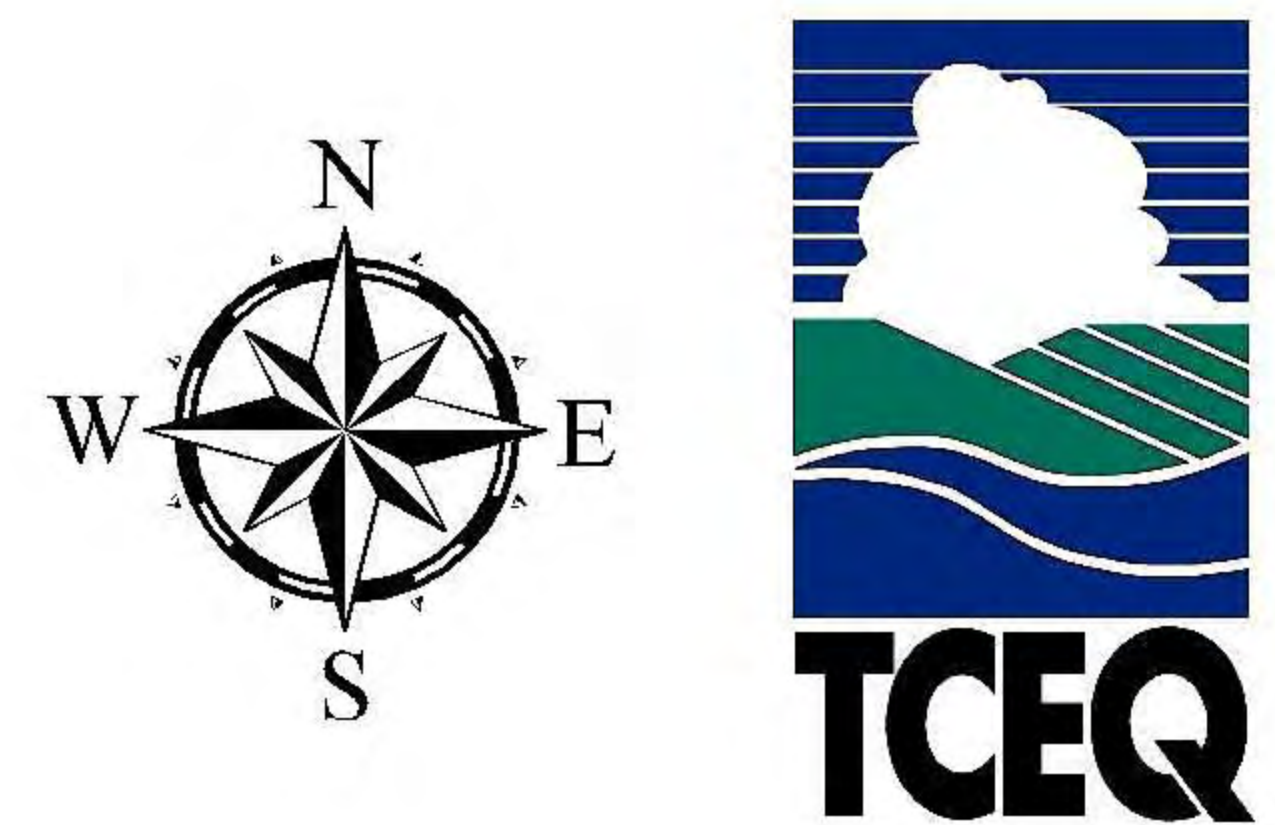


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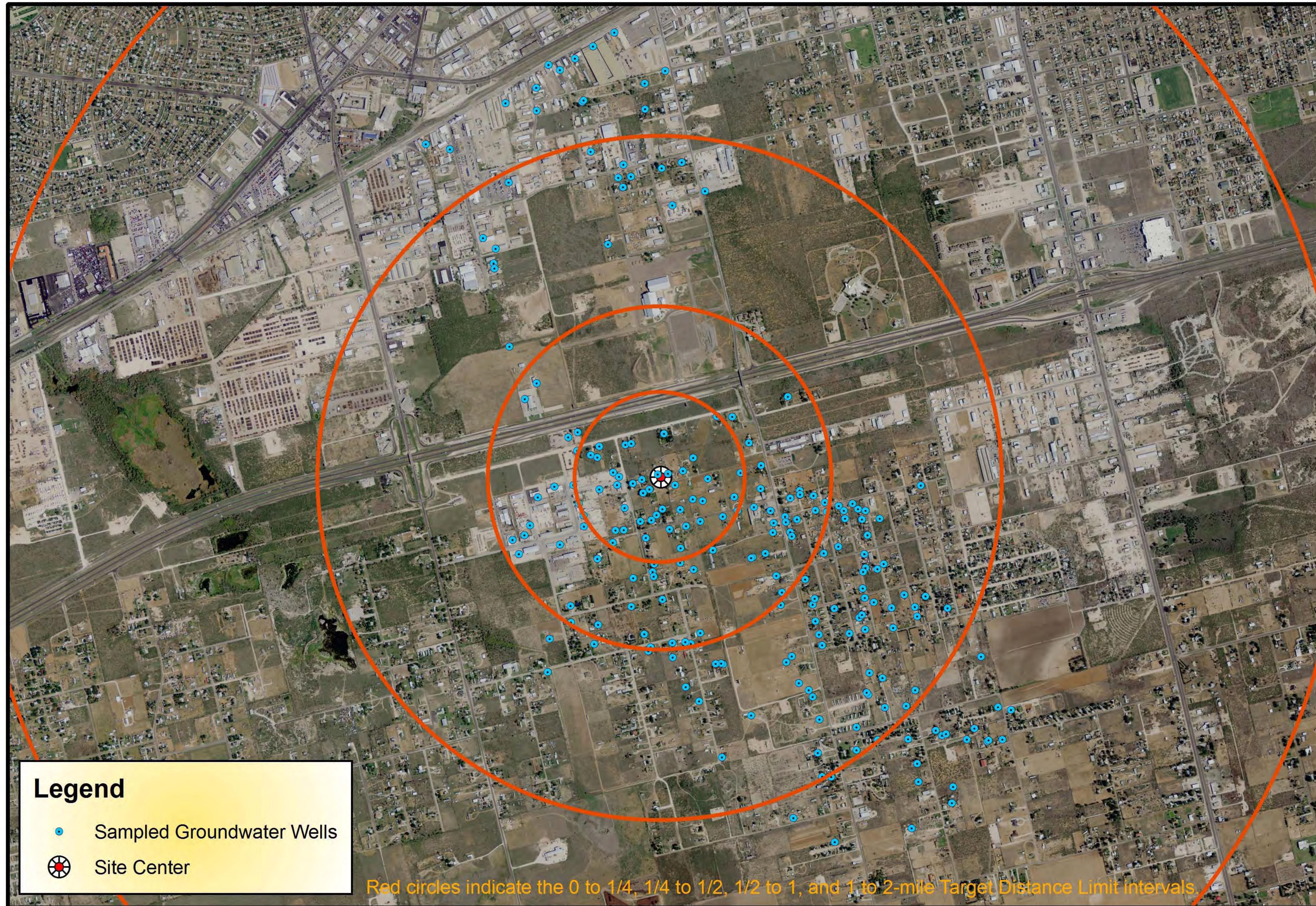
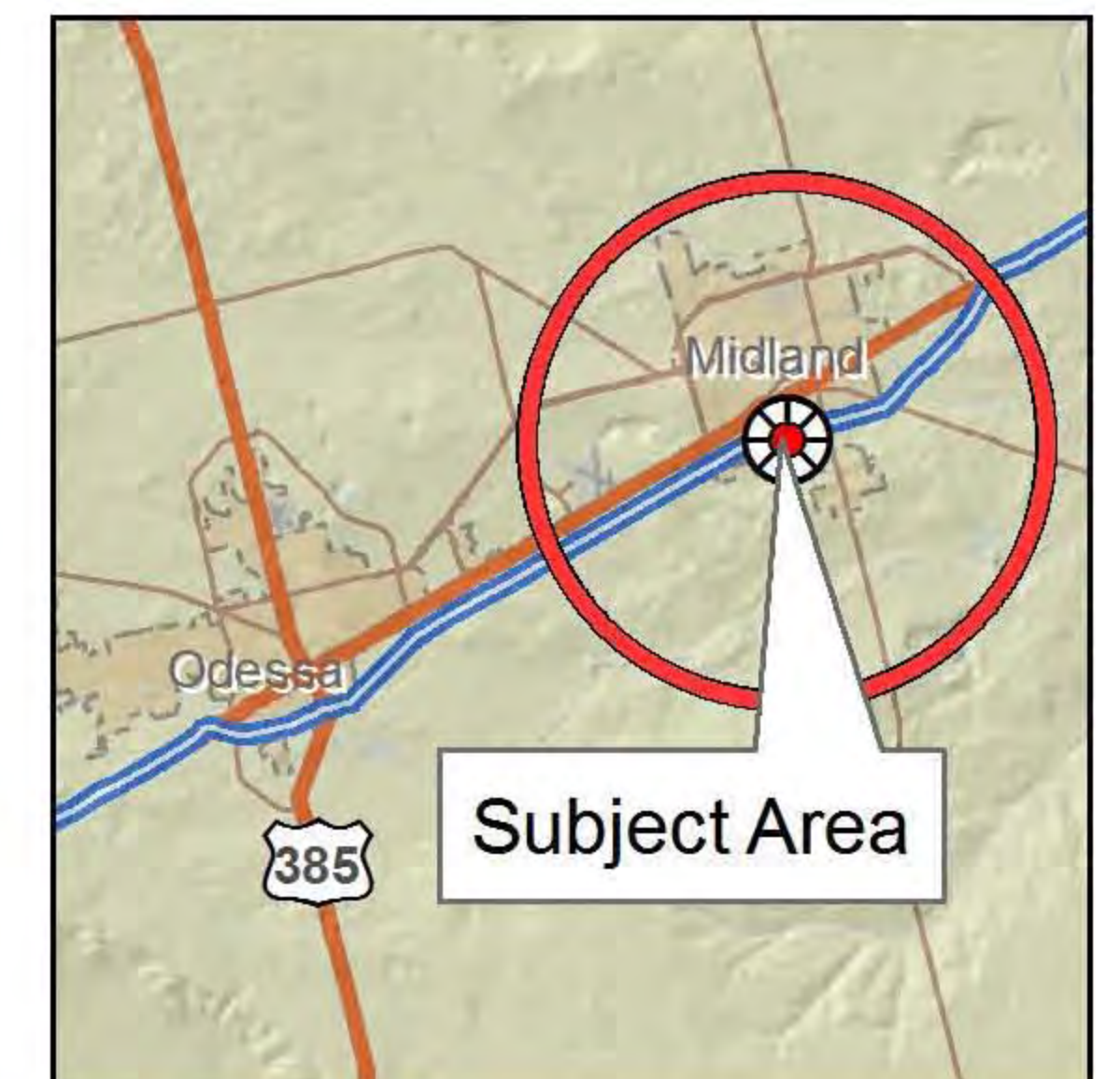


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# Figure 1d: Groundwater Sample Locations



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Red circles indicate the 0 to 1/4, 1/4 to 1/2, 1/2 to 1, and 1 to 2-mile Target Distance Limit intervals.

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## WORKSHEET FOR COMPUTING HRS SITE SCORE

		<u>S</u>	<u>S<sup>2</sup></u>
1.	Ground Water Migration Pathway Score (S <sub>gw</sub> ) (from Table 3-1, line 13)	100	10,000
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	<u>NS</u>	
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	<u>NS</u>	
2c.	Surface Water Migration Pathway Score (S <sub>sw</sub> ) Enter the larger of lines 2a and 2b as the pathway score.	<u>NS</u>	
3.	Soil Exposure Pathway Score (S <sub>s</sub> ) (from Table 5-1, line 22)	<u>NS</u>	
4.	Air Migration Pathway Score (S <sub>a</sub> ) (from Table 6-1, line 12)	<u>NS</u>	
5.	Total of S <sub>gw</sub> <sup>2</sup> + S <sub>sw</sub> <sup>2</sup> + S <sub>s</sub> <sup>2</sup> + S <sub>a</sub> <sup>2</sup>		10,000
6.	<b>HRS Site Score</b> Divide the value on line 5 by 4 and take the square root.		50.00

NS = Not Scored

**TABLE 3-1**  
**GROUND WATER MIGRATION PATHWAY SCORESHEET**

<b><u>Factor Categories and Factors</u></b>		<b><u>Maximum Value</u></b>	<b><u>Value Assigned</u></b>
<b><u>Likelihood of Release to an Aquifer</u></b>			
1.	Observed Release	550	<u>550</u>
2.	Potential to Release		
2a.	Containment	10	
2b.	Net Precipitation	10	
2c.	Depth to Aquifer	5	
2d.	Travel Time	35	
2e.	Potential to Release		
	(Lines 2a(2b + 2c + 2d))	500	
3.	Likelihood of Release		
	(Higher of Line 1 and 2e)	550	<u>550</u>
<b><u>Waste Characteristics</u></b>			
4.	Toxicity/Mobility	*	<u>10,000</u>
5.	Hazardous Waste Quantity	*	<u>100</u>
6.	Waste Characteristics	100	<u>32</u>
<b><u>Targets</u></b>			
7.	Nearest Well	50	<u>50</u>
8.	Population:		
8a.	Level I Concentrations	**	<u>533</u>
8b.	Level II Concentrations	**	<u>10.48</u>
8c.	Potential Contamination	**	<u>17.8</u>
8d.	Population (Lines 8a + 8b + 8c)	**	<u>561.28</u>
9.	Resources	5	<u>0</u>
10.	Wellhead Protection Area	20	<u>0</u>
11.	Targets (Lines 7 + 8d + 9 + 10)	**	<u>611.28</u>
<b><u>Ground Water Migration Score for an Aquifer</u></b>			
12.	Aquifer Score		<u>100</u>
	((Lines 3 x 6 x 11)/82,500)	100	
<b><u>Ground Water Migration Pathway Score</u></b>			
13.	Pathway Score ( $S_{gw}$ ), (Highest value from Line 12 for all aquifers evaluated)	<u>100</u>	<u>100</u>

## REFERENCE LISTING

### Reference

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## SITE DESCRIPTION

The West County Road 112 Ground Water site is designated as a contaminated ground water plume originating from unknown sources composed of hazardous substances that released into the Edwards-Trinity aquifer. The center of the plume is designated as 2604 West County Road 112, Midland, Texas (2604 W CR 112). The plume currently extends 1 ¼ miles from the center of the site at its farthest documented point and is situated under approximately 260 acres of residential and commercial land (Figures 1a through 1d).

Based on the results of the domestic water well located at 2604 W CR 112, ground water samples were collected from April 2009 to November 2009. The ground water plume contains elevated inorganic compounds of chromium and chromium VI, which exceeded three times the background level (See Tables 6-12 of this HRS documentation record). The plume extent is based on delineation of sample points as shown in Figure 2.

As of November 9, 2009, concentrations of chromium in the ground water at the Site exceeded the United States Environmental Protection Agency (EPA) maximum contaminant limit (MCL) of 0.1 mg/L for total and hexavalent chromium in 47 active domestic water wells (Ref. 102, pp.1-3).

The Site is surrounded by residential properties to the south and east, and by commercial and residential properties to the north and west. All residences and commercial businesses south of I-20 receive ground water from private water wells drilled to depths between 60 and 100 feet below ground surface (bgs) (Ref. 110, pp.3-5; Ref. 20, p. 10). The ground water is the sole source of water in this area; the City of Midland does not provide city water south of I-20. Several households purchase drinking water, but all households use the ground water for bathing and other domestic purposes. There are no city water distribution lines within 1 ¼ miles of the Site (Ref. 122, pp. 1-2). Properties north of I-20 currently receive water from the City of Midland (PWS 1650001) (Ref. 123, p. 1; Figure 1c of this HRS documentation Record).

## SOURCE DESCRIPTION

### **2.2 Source Characterization**

#### **2.2.1 Source Identification**

Number of the source: 1

Name and description of the source: Other – Ground Water Plume with No Identified Source

The chromium contamination was reported to the TCEQ when a resident complained of yellow water to the TCEQ Region 7 office (Ref. 103, pp. 1-3). The regional office immediately collected ground water samples from a domestic water well at 2604 West County Road 112 on April 8, 2009 (Ref. 103, pp. 1-3). The concentrations of hexavalent chromium in these samples exceeded the MCL of 0.1 mg/L for chromium (Ref. 3, pp. 1-3; Ref. 103, p. 3; Ref. 121, p. 4).

On April 20, 2009, and April 29, 2009, the TCEQ Region 7 office and TCEQ Superfund Site and Discovery and Assessment Program (SSDAP) personnel collected additional ground water samples from water wells, located on West County Road 112 and West County Road 110, surrounding the well located at 2604 West County Road 112 (Ref. 103, pp. 7-9). On May 4, 2009, SSDAP continued collecting ground water samples from water wells within 1 ¼ mile north and south and ½ mile east and west of the center of the site (2604 W CR 112) (Figure 1d). By November 4, 2009, SSDAP collected ground water samples from 234 water wells (Ref. 104, p. 1).

From July 20, 2009, through July 23, 2009, TCEQ conducted a Site Inspection (SI) (Ref. 106, p. 15). 30 of the 234 drinking water wells were sampled during the SI (Ref. 106, pp. 18-19). The SI also included collection and analysis of five soil samples (including one duplicate) from the center of the site and from surrounding residential areas (Ref. 106, pp. 15-16). Three soil samples were collected at a depth of 0-6 inches, and one sample was collected from a depth of five feet below the ground surface (bgs) (Ref. 106, pp. 15-16). None of the soil samples collected met observed release criteria (Ref. 89, pp. 158-177; Ref. 106, p. 23). Ground water samples from 26 drinking water well locations met the observed release criteria for chromium (Ref. 89, pp. 6-157; Ref. 106, pp. 38-40). For the samples meeting the observed release criteria, all but one sample exceeded the SCDM health based benchmark for chromium of 0.1 mg/L (Ref. 3, pp. 1-3).

The TCEQ continued investigating for a potential source or sources at the site by conducting an Expanded Site Inspection (ESI) during February 1-10, 2010 (Ref. 105, pp. 45-49; Ref. 107, p. 10). The ESI involved sampling a total of 23 monitor wells screened in the Ogallala and Edwards-Trinity aquifers and collecting 8 soil samples at the center of the site (2604 W CR 112) to determine a pattern of chromium concentrations to identify a point of release (Ref. 107, pp. 10 and 13).

Before soil samples were collected at the center of the site (2604 W CR 112), the TCEQ conducted ground-penetrating radar and electromagnetic pulse surveys (Ref. 107, p. 13). These surveys were used to search for buried metal consistent with buried drums. Soil samples were collected based on the results of the ground-penetrating radar and electromagnetic pulse surveys (Ref. 107, p.13). The ground-penetrating radar and electromagnetic pulse surveys report concluded three anomalies were present, in the backyard of 2604 W CR 112, which potentially could indicate the presence of buried drums (Ref. 107, p. 13). Surface structures may have limited the effectiveness of the surveys. Based on the findings of the ground- penetrating radar and electromagnetic pulse surveys eight soil samples, including one field duplicate sample, were collected in areas where buried drums could have been located (Ref. 107, p. 13). However, no drums were found during the soil sampling and the sample results indicated no sources of chromium contamination were identified (Ref. 107, p.13).

A total of 23 monitoring wells were sampled to identify potential source locations for the ESI (Ref. 107, p. 10). The TCEQ opted to use 18 existing monitoring wells within the potential source area as part of the ESI; however, TCEQ installed five new monitoring wells for further plume definition and potential source identification (Ref. 107, p. 10). Two of the five monitoring wells were installed north of the 32 E. Industrial Loop located hydraulically up-gradient of the known chromium plume to establish background values for the Site (Ref. 107, p. ). The remaining three monitoring wells were installed near the center of the site (2604 W CR 112) on properties at 2406 W CR 112; 2700 W CR 112; and 2601 W CR 112 (Ref. 107, p. 11). These wells were installed to evaluate for a potential source of the chromium release in the vicinity of the highest known chromium ground water contamination (Ref. 107, p. 10).

Four of the five monitoring wells were installed by the TCEQ in the uppermost aquifer, the Ogallala aquifer, and one monitoring well was installed in the Edwards-Trinity aquifer (below the Ogallala aquifer) (Ref. 107, pp. 10-11). All wells were installed using an air rotary drilling system (Ref. 33, p. 2). The shallow monitoring wells installed in the Ogallala aquifer were drilled to a target depth of approximately 35 to 60 feet bgs (Ref. 107, p. 10). The wells installed in the Ogallala aquifer were completed with 4-inch PVC casing with fully penetrating 0.020 inch slotted screen. The deep monitoring well installed in the Edwards-Trinity aquifer was drilled to a target depth of approximately 79 feet bgs (Ref. 107, p. 11). The well was advanced at a diameter of 12 1/4 inches to 35 feet bgs and 8-inch steel casing was installed and cemented to isolate the Ogallala aquifer (Ref. 33, p. 1-3). Once the cement had cured, the bore hole was advanced at a diameter of 7 7/8 inches from 35 to 79 feet bgs. The well was then completed with 4-inch PVC casing with fully penetrating 0.0020 inch slotted screen for the Edwards-Trinity aquifer (Ref. 33, p.5).

A total of 26 ground water samples, including three field duplicate samples, were collected from 23 monitoring wells during the ESI (Ref. 107, p. 14). Ground water samples were collected to evaluate the possible source areas for a release of chromium into the West County Road 112 ground water plume. Four locations were identified as possible source(s) of the chromium contamination. Up-gradient and down-gradient ground water samples were collected at all four source locations (Ref. 107, p. 14).

- Two up-gradient (GW-13 & GW-14) and 2 down-gradient (GW-20 & GW-20A) ground water samples were collected in the Ogallala aquifer (GW-13 & GW-20) and Edwards-Trinity aquifer (GW-14 & GW-20A) to determine if a release occurred at the Schlumberger Technology Corporation facility located at 432 E. Industrial Loop (Ref. 107, pp. 19, 24).
- One up-gradient (GW-105) and 5 down-gradient (GW-41, GW-E, GW-41, GW-55, & GW-15) ground water samples were collected in the Ogallala aquifer to determine if a release occurred at the B&W facility located at 4 S. Industrial Loop (Ref. 107, pp. 19, 24).
- Five up-gradient (GW-41, GW-55, GW-10, GW-11 & GW-12) and 3 down-gradient (GW-07, GW-08, & GW-09) samples were collected in the Ogallala aquifer (GW-41, GW-55, GW-10, GW-11, GW-07, & GW-08) and Edwards-Trinity aquifer (GW-12 & GW-09) to determine if a release occurred at the Williamson Gravel Pit located at the corner of S CR 1205 and Harris Ave (Ref. 107, pp. 19, 24).
- Four up-gradient (GW-01, GW-04, GW-05, & GW-06) and two down-gradient (GW-02 & GW-03) samples were collected in the Ogallala aquifer (GW-01, GW-04, GW-05, GW-02, & GW-03) and Edwards-Trinity aquifer (GW-06) to determine if a release occurred at the center of the site located at 2604 W CR 112 (Ref. 107, pp. 19, 24).

The ESI sampling data indicates that the first uppermost aquifer (Ogallala aquifer) was impacted with chromium at the B&W facility, but not at the Schlumberger Technology Corporation facility or the Williamson Gravel Pit (Ref. 107, pp. 25, 30, 31). The data also indicates that the chromium concentrations increase in the Ogallala aquifer in a down-gradient direction starting near the B&W facility and culminate with the highest values observed at 2601 West County Road 112, just south of the center of the site (Ref. 107, p. 31). The data establishes that no elevated chromium contamination was observed in the Ogallala aquifer from the background wells in the vicinity of the Schlumberger Technology Corporation facility and Williamson Gravel Pit. The data suggests that the area defined by the north at the B&W facility via Interstate 20 to the center of the site (2604 W CR 112) is a likely source area for the point of release of chromium to the Ogallala aquifer (Ref. 107, p. 31). Because of the up-gradient concentration patterns observed in the analytical data from the Ogallala aquifer wells and soil data collected at the site center (2604 W CR 112), no known source or sources were identified within the current Site area (Ref. 107, p. 31). The ESI data does not conclusively identify a point of release and suggests there may be a source or sources of chromium in an area bound by the B&W facility to the north (up-gradient) and the center of the site to the south (down-gradient) (Ref. 107, p. 31).

Adequate documentation attributing the hazardous substances to one or more of the potential source areas from the SI and ESI has not been identified. Therefore, a ground water plume

with no identified source was used for HRS scoring. The ground water plume with no identified source was characterized as the site source based on the following:

- The extent of the plume was estimated solely by sampling, using the criteria for an observed release to the Ground Water Migration Pathway (Ref. 1, Section 2.2).
- The level of effort to identify the original source(s) of the hazardous substances by an ESI conducted on February 1- 10, 2010 (Ref. 24, p. 2).

**Location of the source, with reference to a map of the site:**

See Figure 2, Source Area Map. Also, see Reference 134 for source sample locations.

**Source type for HRS evaluation purposes:**

Other - Ground Water Plume with No Identified Source.

**Containment**

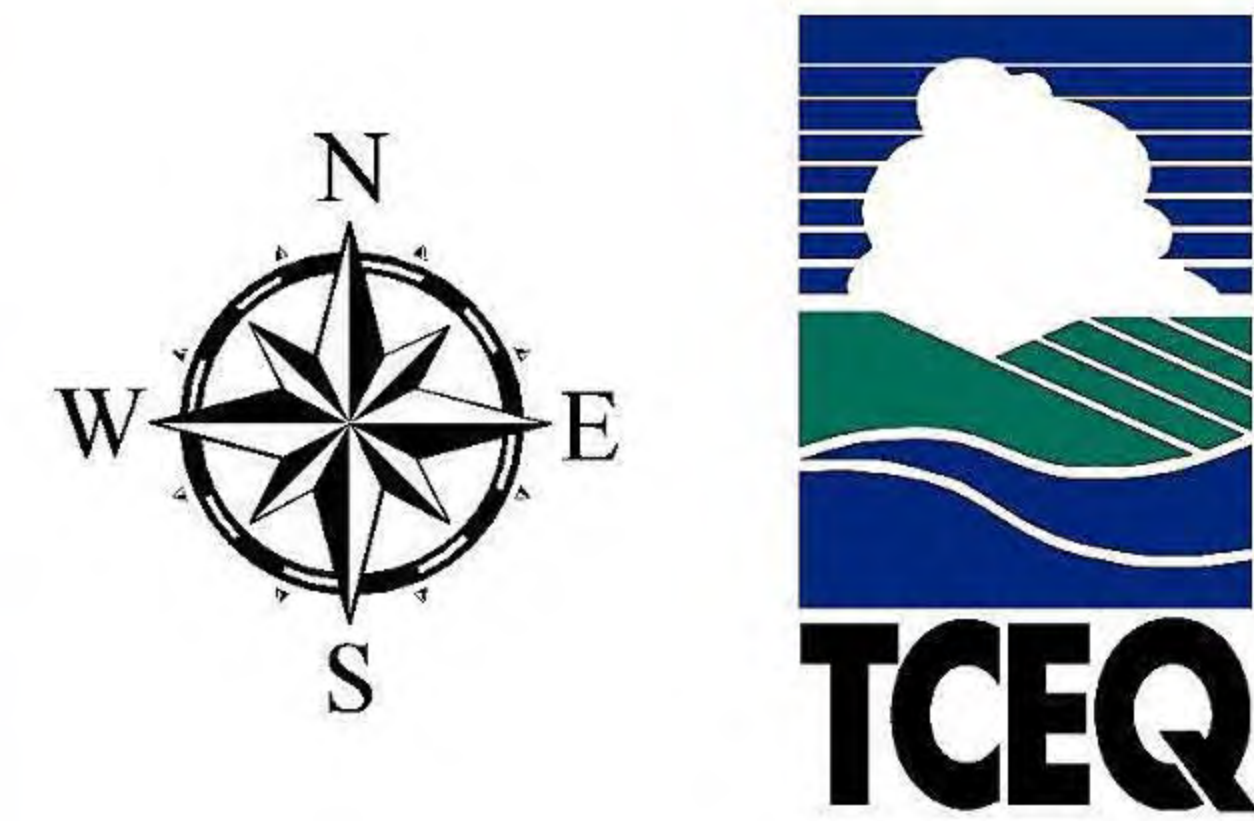
Gas release to air: The air migration pathway was not evaluated; therefore, gas containment was not evaluated.

Particulate release to air: The air migration pathway was not evaluated; therefore, particulate containment was not evaluated.

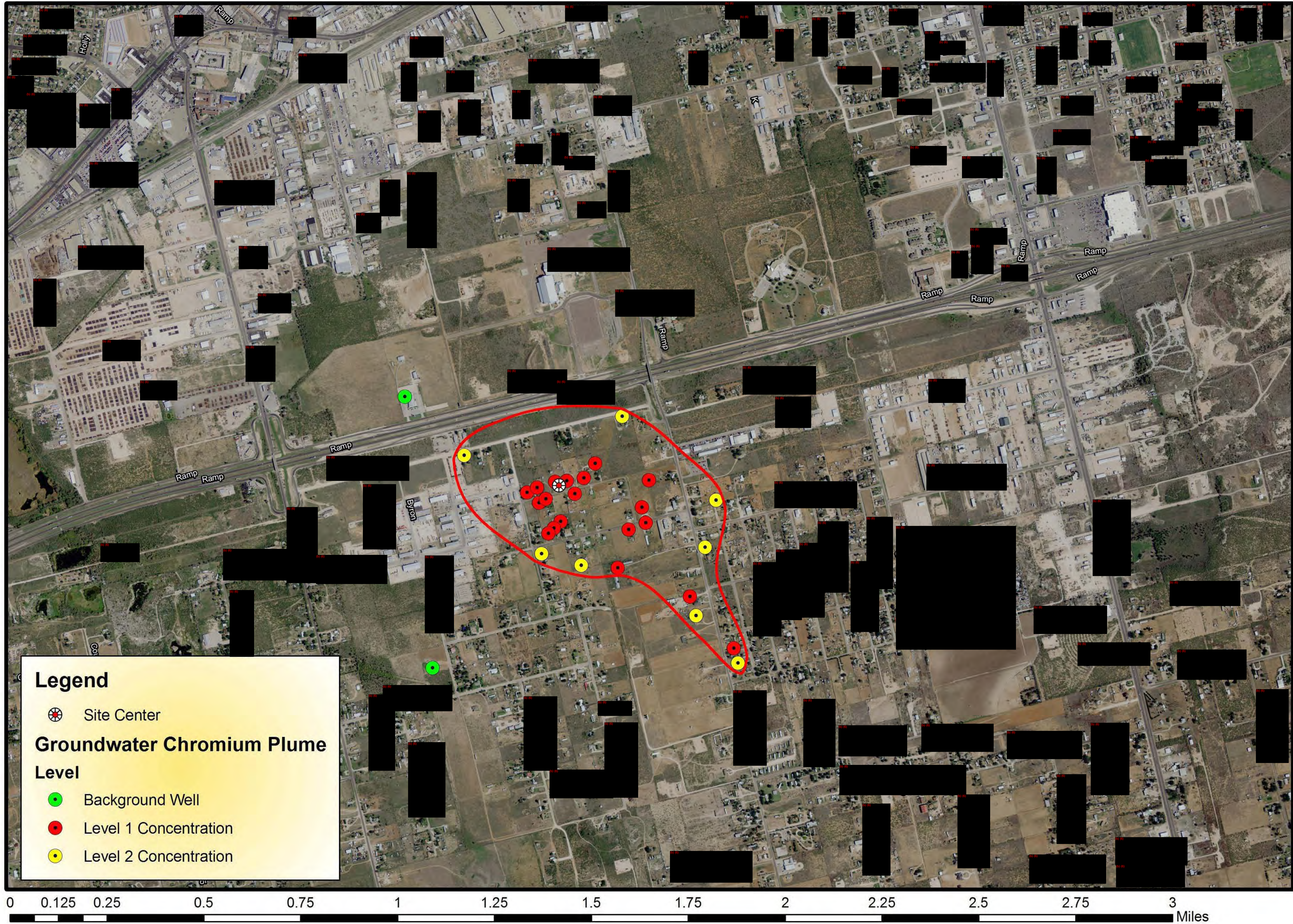
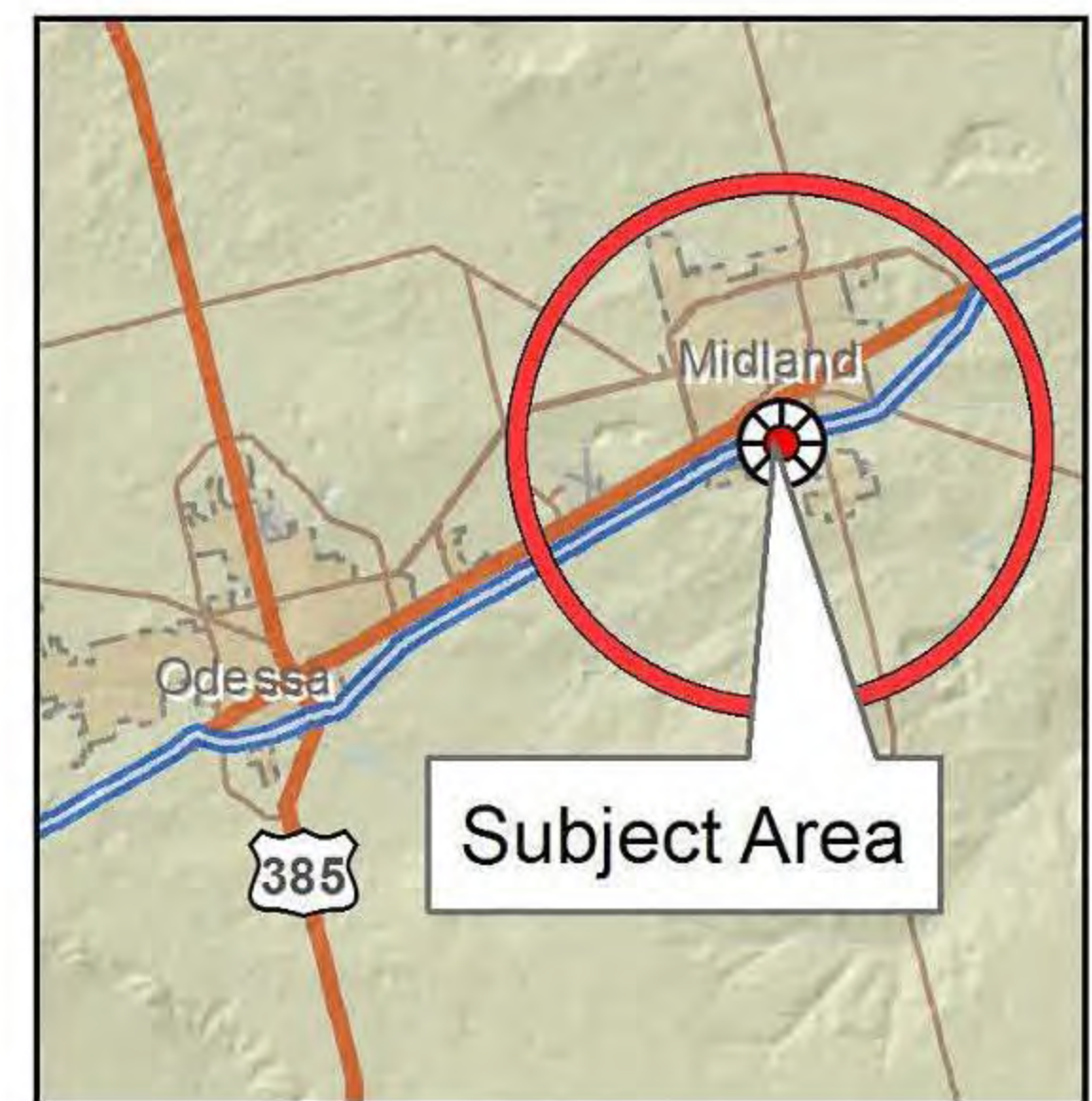
Release to ground water: The Containment Factor Value for the ground water migration pathway was evaluated for “All Sources” for evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures). The applicable containment factor value was determined based on existing analytical evidence of hazardous substances in ground water samples from private and public wells (Table 1). Therefore, based on no liner and evidence of a release, the highest Ground Water Migration Pathway Containment Factor Value of 10 was assigned to Source No. 1 as specified in Table 3-2 of the HRS (Ref. 1, Section 3.1.2.1).

Release to surface water overland/flood migration component: The surface water pathway was not scored; therefore, surface water overland/flood migration component containment was not evaluated.

Figure 2: Source Area Map



West County Road 112  
Groundwater Plume  
Midland, Texas  
(Midland County)  
TXN000606992



The base data set is UTM Zone 13, 0.5 Meter Resolution, Natural Color, NAD 1983 (Ref. 128, pp. 1-4)

This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363.

### **2.2.2 Hazardous Substances Associated With A Source**

The ground water plume with no identified source, Source 1, contains measured levels of chromium and specifically chromium VI, for which observed releases were established within the Edwards-Trinity aquifer, the aquifer being evaluated for the Ground Water Migration Pathway. These hazardous substances were detected above the background level (see Table 5 and Table 6) in samples collected by the TCEQ in 2009, including the SI tasked to the TCEQ by the USEPA, which are given in Table 1 below. All field work was conducted as outlined in the work plan, including the Expanded Site Inspection Health and Safety Plan (HASP), and the TCEQ/EPA approved Quality Assurance Project Plan (QAPP) for TCEQ Preliminary Assessment/Site Inspection Program: Federal Grant Identification Number V-96665501-0 (Ref. 112; Ref. 124). All deviations from the work plan and/or QAPP were noted in the field notebooks. The laboratories that tested the samples for the West County Road 112 Ground water site were:

- Xenco, Odessa, Texas – 12600 West Interstate 20 East, Odessa, Texas 79765 (Tables 5-9 and Tables 11-12)
- EPA Region 6, Houston – 10625 Fall Stone Road, Houston, Texas (Table 10)

The water samples were analyzed by methods CLP ILM05.3, SW6010, and SW846 for inorganic drinking water analysis (See Table 1 and Table 5 through Table 12) The analytical results documented inorganic compounds of chromium and chromium VI greater than or equal to the background sample(s) quantitation limit, if not detected in background samples (see Table 5 through Table 12).

Not all of the depths for the water wells are specified due to lack of information known by the well owner; however, according to residents and local well drillers, the common drilling practice in the site area is to install wells to the bottom of the Edwards-Trinity aquifer at a depth of approximately 100 feet bgs (Ref. 111, pp. 1-2). Most wells in the site vicinity are screened over the two aquifers identified as the Ogallala (uppermost) and Edwards-Trinity aquifers to maximize the production of drinking water for the residences (Ref. 111, pp. 1-2). Most pumps in the domestic wells were placed in the Edwards-Trinity aquifer near the bottom of the well and the well is usually screened across both aquifers to maximize ground water production (Ref. 111, p. 2). For the purpose of this record only those wells installed in the Edwards-Trinity aquifer were included in the Ground Water Migration Pathway Score.

The chromium is present in the drinking water wells due to a release at the Site. The ground water samples were collected from a faucet located on or near the well or from port A of the anion exchange filtration system (port A is located before the ground water from the well enters the anion exchange filtration system).

Well ID**	Well Depth (feet) Below Ground Surface and above Mean Sea Level (msl)*	Date Collected	Contaminant Detected	Reference
GW-005	100 (Ref. 90, p.1) 2695 msl ***	6/30/2009	Chromium VI	Ref. 18, p. 39; Ref. 135, p. 1
GW-011	80 (Ref. 90, p. 2) 2712 msl ***	5/11/2009	Chromium VI	Ref. 16, p. 50; Ref. 135, p. 1
GW-137		6/4/2009	Chromium VI	Ref. 16, p. 85; Ref. 135, p. 1
GW-011		9/16/2009	Chromium	Ref. 23, p. 13; Ref. 135, p. 1
GW-19		7/20/2009	Chromium	Ref. 6, p. 5; Ref. 135, p. 1
GW-020	87 (Ref. 90, p. 4) 2704 msl ***	5/11/2009	Chromium VI	Ref. 16, p. 51; Ref. 135, p. 1
GW-135		6/4/2009	Chromium VI	Ref. 16, p. 77; Ref. 135, p. 1
GW-020		9/16/2009	Chromium	Ref. 23, p. 13; Ref. 135, p. 1
GW-20		7/20/2009	Chromium	Ref. 5, pp. 7-8; Ref. 135, p. 1
GW-023	70 (Ref. 90, p. 3) 2722 msl ***	5/12/2009	Chromium VI	Ref. 16, p. 53; Ref. 135, p. 1
GW-138		6/4/2009	Chromium VI	Ref. 16, p. 84; Ref. 135, p. 1
GW-023		9/16/2009	Chromium	Ref. 23, p. 15; Ref. 135, p. 1
GW-28		7/20/2009	Chromium	Ref. 5, pp. 9-10; Ref. 135, p. 1
GW-029	80 (Ref. 90, p. 7) 2706 msl ***	6/9/2009	Chromium VI	Ref. 17, p. 77; Ref. 135, p. 1
		7/1/2009	Chromium	Ref. 19, p. 35; Ref. 135, p. 1
		9/17/2009	Chromium	Ref. 21, p. 45; Ref. 135, p. 1
GW-042	63 (Ref. 90, p. 9) 2727 msl ***	5/12/2009	Chromium VI	Ref. 16, p. 56; Ref. 135, p. 1
GW-139		6/4/2009	Chromium VI	Ref. 16, p. 86; Ref. 135, p. 1
GW-042		9/16/2009	Chromium	Ref. 23, p. 15; Ref. 135, p. 1
GW-31		7/20/2009	Chromium	Ref. 5, pp.13-1; Ref. 135, p. 14
GW-044	62 (Ref. 90, p. 11) 2727 msl ***	5/12/2009	Chromium VI	Ref. 12, p. 4; Ref. 135, p. 1
GW-140		6/4/2009	Chromium VI	Ref. 16, p. 87; Ref. 135, p. 1
GW-044		9/16/2009	Chromium	Ref. 26, p. 11; Ref. 135, p. 1
GW-21		7/20/2009	Chromium	Ref. 6, pp. 4-5; Ref. 135, p. 1
GW-046	70 (Ref. 90, p. 15) 2729 msl ***	5/12/2009	Chromium VI	Ref. 12, p. 3; Ref. 135, p. 1-2
GW-142		6/4/2009	Chromium VI	Ref. 16, p. 78; Ref. 135, p. 2
GW-046		9/16/2009		Ref. 26, p. 11; Ref. 135, p. 2
GW-29		7/20/2009	Chromium	Ref. 6, pp. 9-11; Ref. 135, p. 2
GW-047	65 (Ref. 103, p. 3) 2725 msl ***	5/12/2009	Chromium VI	Ref. 12, p. 5; Ref. 135, p. 2
GW-143		6/4/2009	Chromium VI	Ref. 16, p. 88; Ref. 135, p. 2
GW-047		9/23/2009		Ref. 21, p. 63; Ref. 135, p. 2
GW-14		7/20/2009	Chromium	Ref. 5, p. 11-12; Ref. 135, p. 2
GW-27	Not specified	7/20/2009	Chromium	Ref. 6, p. 7; Ref. 135, p. 2
GW-053	100 (Ref. 90, p. 16) 2677 msl ***	5/13/2009	Chromium VI	Ref. 12, p. 7; Ref. 135, p. 2
		7/1/2009	Chromium	Ref. 50, p. 8; Ref. 135, p. 2
		9/24/2009	Chromium	Ref. 21, p. 73; Ref. 135, p. 2
		9/23/2009	Chromium	Ref. 21, p. 65; Ref. 135, p. 2
GW-057	96 (Ref. 90, p. 18) 2684 msl ***	5/13/2009	Chromium VI	Ref. 12, p. 11; Ref. 135, p. 2
		7/1/2009	Chromium	Ref. 18, p. 41; Ref. 135, p. 2
		9/24/2009	Chromium	Ref. 21, p. 83; Ref. 135, p. 2
GW-058	65 (Ref. 90, p. 19) 2726 msl ***	5/13/2009	Chromium VI	Ref. 16, p. 65; Ref. 135, p. 2
		7/1/2009	Chromium	Ref. 18, p. 41; Ref. 135, p. 2
		11/4/2009	Chromium	Ref. 21, p. 95; Ref. 135, p. 2
GW-064	Not specified	5/13/2009		Ref. 16, p. 62; Ref. 135, p. 2
		7/1/2009		Ref. 19, p. 43; Ref. 135, p. 2
		9/23/2009		Ref. 21, p. 71; Ref. 135, p. 2
		11/3/2009		Ref. 55, p. 10; Ref. 135, p. 2

Well ID**	Well Depth (feet) Below Ground Surface and above Mean Sea Level (msl)*	Date Collected	Contaminant Detected	Reference
GW-066	68 (Ref. 90, p. 20) 2718 msl ***	5/13/2009	Chromium VI	Ref. 12, p. 12; Ref. 135, p. 2
GW-083	80 (Ref. 90, p. 22) 2710 msl ***	5/13/2009	Chromium VI	Ref. 16, p. 66; Ref. 135, p. 2
		11/3/2009	Chromium	Ref. 17, p. 47; Ref. 135, p. 2
GW-091	100 (Ref. 90, p. 24)	5/19/2009	Chromium VI	Ref. 12, p. 21; Ref. 135, p. 2
GW-091		6/10/2009	Chromium VI	Ref. 17, p. 81; Ref. 135, p. 2
GW-091		9/16/2009	Chromium	Ref. 26, p. 13; Ref. 135, p. 2
GW-08	2709 msl ***	7/21/2009	Chromium	Ref. 5, p. 13; Ref. 135, p. 2
GW-092	80 (Ref. 90, p. 25)	5/19/2009	Chromium VI	Ref. 12, p. 19; Ref. 135, p. 2
GW-092		6/9/2009	Chromium VI	Ref. 17, pp. 75-77; Ref. 135, p. 2
GW-092		9/16/2009	Chromium	Ref. 23, p. 17; Ref. 135, p. 2
GW-13	2710 msl ***	7/21/2009	Chromium	Ref. 6, p. 8; Ref. 135, p. 2
GW-093	90 (Ref. 90, p. 26)	5/19/2009	Chromium VI	Ref. 12, p. 24; Ref. 135, p. 2
GW-093		6/9/2009	Chromium VI	Ref. 17, p. 75; Ref. 135, p. 2
GW-093		9/16/2009	Chromium	Ref. 23, p. 17; Ref. 135, p. 2
GW-12	2700 msl ***	7/21/2009	Chromium	Ref. 21, p. 22; Ref. 135, p. 3
GW-098	80 (Ref. 90, p. 29)	5/21/2009	Chromium VI	Ref. 17, pp. 47-49; Ref. 135, p.3
		6/9/2009	Chromium VI	Ref. 17, p. 75; Ref. 135, p. 3
	2710 msl ***	9/22/2009	Chromium	Ref. 21, p. 59; Ref. 135, p. 3
GW-099	80 (Ref. 90, p. 30)	5/19/2009	Chromium VI	Ref. 12, p. 28; Ref. 135, p. 3
		6/10/2009	Chromium VI	Ref. 17, p. 83; Ref. 135, p. 3
	2709 msl ***	9/17/2009	Chromium	Ref. 26, p. 19; Ref. 135, p. 3
GW-102	78 (Ref. 90, p. 32) 2705 msl ***	5/20/2009	Chromium VI	Ref. 17, pp. 17-19; Ref. 135, p. 3
		6/10/2009	Chromium VI	Ref. 17, p. 85; Ref. 135, p. 3
GW-103	120 (Ref. 90, p. 33)	5/20/2009	Chromium VI	Ref. 12, p. 30; Ref. 135, p. 3
		6/10/2009	Chromium VI	Ref. 17, pp. 83-85; Ref. 135, p. 3
	2684 msl ***	9/17/2009	Chromium	Ref. 21, p. 43; Ref. 135, p. 3
GW-104	80 (Ref. 90, p. 34) 2706 msl ***	5/21/2009	Chromium VI	Ref. 17, p. 45; Ref. 135, p. 3
GW-104		6/10/2009	Chromium VI	Ref. 17, p. 85; Ref. 135, p. 3
GW-104		6/30/2009		Ref. 19, p. 32; Ref. 135, p. 3
GW-11		7/22/2009	Chromium	Ref. 88, pp. 1-10; Ref. 135, p. 3
GW-104		9/17/2009	Chromium	Ref. 21, p. 39; Ref. 135, p. 3
GW-126	80 (Ref. 90, p. 42)	5/20/2009	Chromium VI	Ref. 17, pp. 25-27; Ref. 135, p. 3
GW-126		6/11/2009	Chromium VI	Ref. 17, p. 89; Ref. 135, p. 3
GW-126		9/17/2009		Ref. 23, p. 19; Ref. 135, p. 3
GW-15	2696 msl ***	7/22/2009	Chromium	Ref. 5, pp. 37-38; Ref. 135, p. 3

Well ID**	Well Depth (feet) Below Ground Surface and above Mean Sea Level (msl)*	Date Collected	Contaminant Detected	Reference
GW-150	80 (Ref. 90, pp. 46,47)  2691 msl ***	6/9/2009	Chromium VI	Ref. 16, p. 89; Ref. 135, p. 3
		7/1/2009	Chromium	Ref. 19, p. 43; Ref. 135, p. 3
		7/14/2009	Chromium	Ref. 19, p. 85; Ref. 135, p. 3
		9/24/2009	Chromium	Ref. 21, pp. 75-77; Ref. 135, p. 3
GW-151	80 (Ref. 90, pp. 46,47)  2690 msl ***	6/9/2009	Chromium VI	Ref. 16, p. 90; Ref. 135, p. 3
		11/3/2009	Chromium	Ref. 44, p. 5-6; Ref. 135, p. 3
GW-152	70 (Ref. 90, pp. 46,47)  2699 msl ***	6/9/2009	Chromium VI	Ref. 16, p. 91; Ref. 135, p. 3
		9/23/2009	Chromium	Ref. 21, pp. 63-65; Ref. 135, p. 3
GW-160	90 (Ref. 90, p. 49)  2708 msl ***	6/11/2009	Chromium VI	Ref. 17, pp. 89-91; Ref. 135, p. 3
GW-34	Not Specified	7/22/2009	Chromium	Ref. 5, pp. 39-40; Ref. 135, p. 3
GW-260	90 (Ref. 90, p. 55)  2709 msl ***	7/29/2009	Chromium	Ref. 63, p. 4; Ref. 135, p. 4
GW-261	Not specified	7/1/2009	Chromium VI	Ref. 23, p. 21; Ref. 135, p. 4
GW-292	80 (Ref. 90, p. 56)  2699 msl ***	9/15/2009	Chromium	Ref. 21, pp. 5-6; Ref. 135, p. 4
GW-293	140 (Ref. 90, p. 57)  2639 msl ***	9/15/2009	Chromium	Ref. 21, pp. 7-8; Ref. 135, p. 4
GW-336	74 (Ref. 90, p. 62)  2715 msl ***	11/4/2009	Chromium	Ref. 23, p. 75; Ref. 135, p. 4
GW-344	65 (Ref. 90, p. 63)  2753 msl ***	9/16/2009	Chromium	Ref. 26, p. 9; Ref. 135, p. 4

Note:

\* Ref. 111, pp. 1-2

\*\* Some sample locations have multiple Sample IDs. However, the multiple Sample IDs correspond to the same sample location. The multiple Sample ID numbers are due to use of different Sample IDs during different sampling events at those sampling locations.

\*\*\* Well depth in feet above mean sea level (msl) was determined for each well by subtracting the feet below ground surface from the msl identified on the USGS Topographic Map, Southeast Midland 1:24,000, revised map dated 1974 obtained from TNIRIS.

### 2.2.3 Hazardous Substances Available to a Pathway

The containment factor value for Source 1 is greater than 0 (see Containment in Section 2.2.1 of this documentation record). The following hazardous substances associated with the ground water plume source can migrate via the ground water pathway:

Table 2: Hazardous Substance Available to a Pathway							
Hazardous Substances	Air Pathway		Ground Water	Surface Water		Soil Exposure	
	Gas	Particulate		Overland/ Flood	GW to SW	Resident	Nearby
Chromium	NS	NS	Y	NS	NS	NS	NS
Chromium VI	NS	NS	Y	NS	NS	NS	NS

Notes and Qualifiers:

NS = Not Scored

Y = Yes

### 2.3 Likelihood of Release

Refer to Section 3.1 of this documentation record for specific information related to Likelihood of Release to the Ground Water Pathway.

### 2.4 Waste Characteristics

#### 2.4.1 Selection of Substance Potentially Posing Greatest Threat

The hazardous substances with the highest toxicity/mobility factor values available to the ground water migration pathway are chromium (10,000) and chromium VI (10,000). Therefore, chromium and chromium VI are the hazardous substances associated with this source posing the greatest hazard (Ref. 1, Sections 2.4.1.2, 3.2.1).

#### 2.4.2 Hazardous Waste Quantity

##### 2.4.2.1 Source Hazardous Waste Quantity

###### 2.4.2.1.1 Hazardous Constituent Quantity (Tier A) – Not Evaluated (NE)

The information available is not sufficient to evaluate Tier A as required in Section 2.4.2.1.1 of the HRS, which is to determine mass of the hazardous substance present in the waste source. As a result, the evaluation of Hazardous Waste Quantity proceeds to the evaluation of Tier B, hazardous waste quantity (Ref. 1, Section 2.4.2.1.1).

###### 2.4.2.1.2 Hazardous Waste Stream Quantity (Tier B) - NE

There is not sufficient information to evaluate Tier B which requires determining mass of the hazardous substance and additional CERCLA pollutants and contaminants that are allocated to the source as required in the HRS. (Ref. 1, Section 2.4.2.1.2) As a result the evaluation of

Hazardous Waste Quantity proceeds to the evaluation of Tier C, volume (Ref. 1, Section 2.4.2.1.2).

#### **2.4.2.1.3 Volume (Tier C)**

For the migration pathways, the source is assigned a value for volume using the appropriate Tier C equation from HRS Table 2-5 (Ref. 1, Section 2.4.2.1.3). The hazardous waste quantity for a plume site with no identified source can be determined by measuring the area within all observed release samples combined with the vertical extent of contamination to arrive at an estimate of the plume volume (Ref. 24, p. 4).

However, the extent of the ground water plume is unknown because existing water wells are the only locations where chromium and chromium VI have been documented to date. Therefore, the volume of the ground water plume is assigned a volume hazardous waste quantity value greater than (>) 0. The value of >0 reflects that the volume is known to be greater than 0, but the exact amount is unknown.

#### **2.4.2.1.4 Area (Tier D) - NE**

The area measure (Tier D) cannot be evaluated because the hazardous waste quantity table in the HRS (Ref.1, Table 2-5) does not provide a divisor for source type “other” in this tier (Ref. 24, p. 4).

#### **2.4.2.1.5 Source Hazardous Waste Quantity Value**

As described in the HRS, the highest value assigned to a source from among the four tiers of hazardous constituent quantity (Tier A), hazardous waste stream quantity (Tier B), volume (Tier C) or area (Tier D) was selected as the source hazardous waste quantity value (Ref. 1, Section 2.4.2.1).

<b>Table 3: Source Hazardous Waste Quantity Source 1 - Other - Ground Water Plume with No Identified Source</b>	
<b>Tier Measure</b>	<b>Migration Pathway (Ground Water)</b>
Tier A, Constituent Quantity	NE
Tier B, Waste stream Quantity	NE
Tier C, Volume	> 0
Tier D, Area	0

NE = Not Evaluated

<b>Source No. 1, Other - Groundwater Plume with No Identified Source, Hazardous Waste Quantity Value: &gt; 0</b>
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## SOURCE SUMMARY

The TCEQ SSDAP and Region 7 office conducted initial sampling and monitoring activities from April to November 2009 at the West County Road 112 Ground Water Site. During the initial assessment period, approximately 234 water wells were sampled (Ref. 104, p. 1). The source hazardous waste quantity and containment for the site is summarized in the table below.

The hazardous constituent quantity data is not adequately determined for one or more sources for the site. The targets for the Ground Water Migration Pathway are subject to Level I concentrations (see Table 15 through Table 18).

<b>Table 4: Source Summary</b>						
<b>Source Number</b>	<b>Source Hazardous Waste Quantity Value</b>	<b>Containment</b>				
		<b>Ground Water</b>	<b>Surface Water</b>	<b>Soil Exposure</b>	<b>Gas</b>	<b>Air Particulate</b>
1	> 0	10	NE	NE	NE	NE
<b>TOTAL</b>	<b>&gt; 0</b>					

NE = Not Evaluated

## POSSIBLE SOURCES

The site is designated as a chromium contaminated ground water plume originating from an unknown source or sources. A number of known industries use or have historically used chromium and/or are located hydraulically up-gradient within one mile of the site. In addition, the center of the site was investigated as a possible source. The ESI focused on the following locations as possible sources of the chromium contamination:

1. The Dowell Midland facility now known as the Schlumberger Technology Corporation is located north within 1 mile of the site boundary. The Dowell Midland facility, a division of Schlumberger Technology Corporation, is in the TCEQ's corrective action program (SWR # 33591) due to a release of volatile organic compounds (VOCs) to the ground water (Ref. 126, p. 1). The Dowell Midland facility is monitoring ground water for VOCs, chloride, total petroleum hydrocarbons, nickel, sulfates, carbonate, bicarbonate, calcium, magnesium, sodium, potassium, and arsenic (Ref. 118, pp. 5; Ref. 126, p. 1). In 1994, the soil and ground water at the facility were tested for the presence of chromium. Because the analytical results for chromium were below action levels, the TCEQ determined no further action was warranted to monitor chromium in the ground water (Ref. 125, p. 1). The Notice of Registration (NOR) for industrial and hazardous waste at the above location does not indicate that chromium is or has been used at the facility (Ref. 114). Although the NOR for the facility does not indicate that chromium has been used or managed at the facility, it is hydraulically up-gradient of the site and is considered a possible source (Ref. 117, p. 23; see also Section 2.2.1 of this HRS documentation record).
2. The B&W Welding and Construction facility (EPA ID No.TXD981055080) is an abandoned metal fabrication and welding facility located approximately  $\frac{3}{4}$  of a mile northwest of the center of the facility. The B&W Welding and Construction facility is hydraulically up-gradient of the site (Ref. 117, p. 22; see also Section 2.2.1 of this HRS documentation record). Since 1984, the site has been investigated for releases of chromium to soil and ground water (Ref. 113, pp. 7-8). An assessment conducted by Lear Corporation (SWR # 23041) identified a 100-foot-long by 40-foot-wide area of chromium impacted ground water at the B&W facility; however, according to Lear Corporation's assessment, the source of the chromium release had not been identified onsite (Ref. 115, pp. 2-3). The Lear Corporation operated a plastic manufacturing plant and was cross-gradient from the B&W facility. The Lear Corporation had taken responsibility for the cleanup of the total and hexavalent chromium ground water contamination on the B&W site; however, the Lear Corporation has filed for bankruptcy and is no longer providing remedial actions at the B&W facility (Ref. 127, p. 1).
3. The Williamson Gravel Pit is located  $\frac{3}{4}$  of a mile north of the center of the site (Figure 1c). Local residents and a B&W Welding and Construction report have claimed that illegal disposal of chromium may have occurred at the Williams Gravel Pit, which is a caliche borrow pit (Ref. 113, pp. 6-7). The Williamson Gravel Pit is

located hydraulically up-gradient of the site and located hydraulically down-gradient of the B&W and Schlumberger Technology Corporation sites (Ref. 117, p. 23; see also Section 2.2.1 of this HRS documentation record).

4. The center of the site (2604 West County Road 112) is the discovery location of the hexavalent chromium ground water contamination (Ref. 103, pp. 1-2). The TCEQ's analytical results from the drinking water well (at 2604 WCR 112) indicate this location has the highest concentration of chromium (5.25 mg/L) detected in the ground water associated with the ground water chromium plume (Ref. 103, p. 3). The current residents bought the house in 2000 (Reference 103, pp. 6). When they moved into the dwelling, the external and internal property was in disarray (Ref. 103, pp. 11). The current residents do not have any knowledge of wastes buried on their property; however, there were empty marked and unmarked 55-gallon drums on-site when the current residents moved into the house. The drums were later disposed of by the TCEQ's contractor at a drum disposal facility. The center of the site is hydraulically down-gradient of the B&W facility, Williamson Gravel Pit, and Schlumberger Technology Corporation (Ref. 117, p. 23; see also Section 2.2.1 of this HRS documentation record).

### 3.0 GROUND WATER MIGRATION PATHWAY

#### 3.0.1 General Considerations

The primary drinking water aquifer in Midland County and underlying the Site is the Edwards-Trinity aquifer (Ref. 7, p. 5; Ref. 8, p. 18). The Edwards-Trinity aquifer is the most significant source of water on the Edwards Plateau, which covers approximately 23,000 square miles in southwest Texas (Ref 8, p. 69). Most recharge to the Edwards-Trinity aquifer results from the infiltration of precipitation from land surface and seepage losses through stream beds and intermittent streams (Ref. 7, p. 44). An uncertain amount of cross-formational flow from the Ogallala aquifer provides recharge to the Edwards-Trinity aquifer system in the northwestern portion of the aquifer (Edwards-Trinity aquifer near Site) (Ref. 8, p. 60).

A secondary source of drinking water under the Site is the Ogallala aquifer, which stratigraphically overlies the Edwards-Trinity aquifer (Ref. 8, pp. 20, 73). The Ogallala Formation sediments often occur above the water table in Ector, Midland and Glasscock counties where saturated Cretaceous sediments (i.e., Trinity Group Formation of the Edwards-Trinity aquifer) form the predominant aquifer (Ref. 8, p. 69). Where significant saturated thickness occurs in Cretaceous sediments, the Trinity Group Antlers sand [Edward-Trinity aquifer] is the dominant aquifer material and it is difficult to differentiate between both aquifers [the Ogallala and Edward-Trinity aquifers] (Ref 8, p. 69). Although the Ogallala is not a major drinking water source in the vicinity of the Site, drinking water wells at the Site are typically screened in both aquifers to promote hydraulic communication between the aquifers so water availability will be optimized (Ref. 9, p. 25; Ref. 111, p.2).

The boundary between the two aquifers [Ogallala and Edwards-Trinity] is transitional and is not well defined in the Southern High Plains and the northwestern margin of the Edwards Plateau (the location of the Site) (Ref. 8, p.73). This area is where a transition occurs between the Southern Ogallala and Edwards- Trinity aquifers (Ref. 8, p. 69). Wells in the vicinity of the Site typically have a fine-grained layer (e.g., clay) or slate or shale layer that differentiates the Ogallala formation [aquifer] from the underlying Trinity Group Formation of the Edwards-Trinity aquifer (Ref. 11, pp 5, 10, 13, 15; Ref. 33, pp. 3, 7; Ref. 39, pp. 3, 5, 11, 17, 19; Ref 111, p. 1-2;).

Average annual precipitation for Midland County is 15-20 inches per year (Ref. 11, p. 6). The center of the site is most likely on Arvana fine sandy loam soil of low relief and a typical profile of loamy eolian deposits up to 40 inches below ground surface. The soil is well drained with variable permeability (Ref. 12, pp. 1-4).

To understand the hydrogeologic or aquifer characteristics of the Ogallala and Edwards-Trinity aquifers, the geologic strata that compose the aquifers are described first. The geologic strata, from youngest to oldest, are:

**Stratum: 1****Stratum Name:** Eolian

Post-Ogallala Formation sediments consist primarily of windblown (eolian) sand and silt, alluvium, and lacustrine deposits (playa lake deposits). Eolian sands occupy the largest surface area of the High Plains of Texas and are of both Pleistocene and Recent (Holocene) age. They are primarily fine-grained to silty, sometimes calcareous, and are derived from lacustrine, fluvial, and eolian deposits. These sands and silts form sheet or cover sand, dunes, and dune ridges with thicknesses generally ranging from 0 to 10 feet. Alluvium is present as fluvial floodplain and terrace sediments along the more active streams and rivers. The deposits consist of poorly sorted, often cross-bedded, gravel, sand, and silt. Lacustrine deposits, consisting primarily of clay and silt, line the bottom of the many playa lakes on the High Plains (Ref. 9, p. 33).

At the West County Road 112 Ground Water Site, the surface and shallow subsurface deposits attributed to eolian or lacustrine deposits are typically encountered from the surface to a depth of about 15 feet. The deposits are typically brown sand, sandy silts, and silty sands (Ref. 11, pp 4, 5, 9, 12, 14; Ref. 39, pp. 3, 5, 11, 15, 19).

**Geologic Stratum: 2****Stratum Name:** Caliche

Caliche deposits underlie much of the surface of the Southern High Plains of Texas and typically separate the Ogallala Formation from overlying eolian sediments of Pleistocene and Recent age deposits. Near the surface of much of the Texas High Plains are layers of resistant caliche known as “caprock”. Caliche occurs in both Ogallala and post-Ogallala sediments and is formed by the leaching of carbonate and silica from surface soils and the redeposition of the dissolved minerals layers below the surface. Although caliche layers occur primarily near the surface, deeper zones of caliche are also present (Ref. 9, p. 28).

At the West County Road 112 Ground Water Site, significant caliche horizons are typically encountered near the ground surface in the soils at approximately 3 to 15 feet below ground surface (Ref. 11, pp 4, 5, 9, 12, 14; Ref. 39, pp. 3, 5, 11, 15, 19).

**Geologic Stratum: 3****Stratum Name:** Ogallala Formation

Tertiary sediments - While deposition was occurring in the Gulf of Mexico in post-Cretaceous geologic history, widespread uplift and erosion was occurring in west-central Texas. A large volume of Cretaceous rock was removed from present day Midland County during late Mesozoic through early Cenozoic time (i.e., Paleocene, Miocene, and Pliocene), as the result of structural deformation, salt dissolution, and erosion along what is now the Pecos River Valley. Then, during the Cenozoic Era, a thick

succession of off-lapping deltaic deposits built the plains along the coast with detritus eroded from Paleozoic and Mesozoic rocks from the uplifted continental interior (Ref. 25, p. 20).

The Ogallala Formation of late Miocene/Pliocene age unconformably overlies Cretaceous aged sediment (Ref. 9, p. 13). Ogallala sediments consist primarily of fine- to coarse-grained elastics from the southern Rocky Mountains to the west (Ref. 9, p. 13). The sands are generally tan, yellow, or reddish brown, medium- to coarse-grained, moderately- to well-sorted, unconsolidated quartz grains, interbedded with thin layers of clay and occasionally sandstone. Gravel commonly occurs in layers in the basal section of the Ogallala Formation and ranges in size from boulders to pea size. The gravel is usually associated with sand, silt, and clay and is occasionally cemented. Quartzite is the predominant rock type in the gravel, although a high percentage of limestone boulders and cobbles occur in the southern third of the study area along with weathered Cretaceous invertebrate fossils (Ref. 9, p. 27).

At the West County Road 112 Ground Water Site, sediments attributed to the Ogallala Formation are typically encountered from approximately 10 feet to 60 feet bgs. These deposits are primarily sands, silty sands with clay and gravel deposits, which grade into sandstones in the deeper deposits. Often, the bottom confining layer will have clay, slate or shale to mark the top of the Trinity Group Formation (Ref. 11, p. 7; Ref. 39, pp. 9, 7, 21).

#### **Geologic Stratum: 4**

Stratum Name: Trinity Group Formation

Early Cretaceous sediments - The Trinity Group rock record indicate a cyclic pattern of shoreline advance and retreat, superimposed upon an overall pattern of marine transgression (Ref. 25, p. 11). In early Cretaceous times, a broad continental shelf formed around a rifting and subsiding ancestral Gulf of Mexico basin. The Edwards and Trinity strata formed atop and landward of this continental shelf. As the sea level rose and advanced westward, inland alluvial plains deposited clastic materials along shorelines (Ref. 25, p. 11). The Trinity sands were formed west of the Llano uplift where "typically it amassed as a sprawling, braided stream deposit atop an eroded surface of the pre-Cretaceous rocks" (Ref. 25, p. 15). Shallow offshore environments also promoted the biogenic accumulation of calcium carbonate (Ref. 25, p. 11).

The Trinity Group is represented by the Antlers Formation in the southern part of the High Plains area. These rocks are considered to be equivalent to the Paluxy Sand of Central Texas, and are generally referred to as the "Trinity Sand" in the High Plains (Ref. 9, p. 24). In places, the Antlers forms a basal sand unit (aka. Basal Cretaceous Sands) in the Cretaceous system in the southeastern and southern portions of the High Plains (Ref. 8, p. 49). It is a white to purple, loosely consolidated, fine- to coarse-grained, quartz sandstone, locally hard, and commonly interbedded with fine-grained yellow sand, green clay, and gray to pink siltstone. Scattered lenses of gravel occur throughout the unit, but a more persistent, basal conglomeratic unit with interbedded coarse sand is present in most sections. Where a sufficient saturated thickness of Ogallala sediments overlies the Antlers, the well completion interval usually encompasses both formations. In Ector, Midland, and part of Glasscock

Counties, the Antlers sand yields more water of acceptable quality than any other water-bearing formation. (Ref. 9, p. 25).

At the West County Road 112 Ground Water Site, the Trinity Group is typically encountered from approximately 65 feet bgs to approximately 100 feet bgs. The Trinity Group is usually tan sandstone with layers of clay interbedded. Usually, the bottom confining unit is the red clays and shales of the Chinle Formation of the Dockum Group at approximately 100 feet bgs in the Site vicinity (Ref. 11, pp 6, 7, 13, 15; Ref. 39, pp. 7, 9, 13, 17, 21).

### **Geologic Stratum: 5**

Stratum Name: Dockum Group

Late Triassic sediments - During the late Triassic time, Paleozoic rocks were eroded from the surrounding high ground and deposited in low-lying fluvial, deltaic, and lacustrine environments as red beds of the Dockum Group (Ref. 7, pp. 14 and 16). The Upper Dockum Group is comprised of the Trecovas, Santa Rosa, and the uppermost Chinle formation, which underlies the Trinity Group at the site. The Chinle Formation consists of up to 600 feet of red, blue, and reddish brown clays and shales (Ref. 9, p. 22). At the West County Road 112 Ground Water Site, the Chinle Formation of the Dockum Group is typically encountered below the Trinity Group at approximately 100 feet bgs depending on site-specific geology (Ref. 11, pp 1-16).

### **Aquifer System**

The aquifers that have been impacted by the West County Road 112 Ground Water Site are the Ogallala and the Edwards-Trinity aquifers (Ref. 7, p. 7; Ref. 25, p.3). Regionally, the site falls within an area where one major aquifer system ends and another one begins: The High Plains aquifer system, mainly the Ogallala Formation in the study area, overlies the eroded surface of the Trinity Group, mainly the Trinity Sands/Antlers Formation, which is at the extreme upgradient part of the Edwards-Trinity aquifer System (Ref. 10, p.8; Ref. 7, pp. 20-21). Specifically, the Edwards-Trinity aquifer consists of Mesozoic (Cretaceous) formations, which are underlain by Paleozoic (Triassic) formations and overlain by Cenozoic (Tertiary and Quaternary) formations (Ref. 7, pp. 20-21).

The hydrogeologic units present at the site are as follows, from youngest to oldest:

### **Hydrogeologic Stratum: 1**

Stratum Name: High Plains/Ogallala/Tertiary Aquifer

The Ogallala aquifer is located in Andrews, Ector, Glasscock, Howard, Martin, and Midland counties in the Edwards Plateau area. The Ogallala aquifer is composed primarily of sand, gravel, clay, and silt and generally has a saturated thickness of less than 100 feet in the Edwards Plateau area. The Ogallala aquifer partially overlies the Edwards-Trinity (Plateau) aquifer in the Edwards Plateau area (Ref. 8, p. 20).

As the ancestral Rocky Mountains were eroded during the Tertiary, southeasterly flowing streams carried and deposited sediments to their present day locations across the Texas High Plains and ending in Midland County. The earliest sediments, mainly gravel and coarse sand, filled the valleys cut in the Cretaceous, Triassic, and Permian surfaces (Ref. 22, p.17). The Ogallala Formation consists of red and yellow clay, silt, fine to coarse gray and buff colored sand, gravel and caliche (Ref. 22, p. 31). The fine to coarse sand, with the fine to medium grades predominate (Ref. 22, p. 32). In the Odessa-Midland area, the Ogallala Formation consists of reworked basal conglomerates of Triassic and Cretaceous fragments locally overlain by fine pink sandstone and/or caliche Acaprock® with a maximum thickness of approximately 20 to 25 feet (Ref. 22, p. 32). Caprock consists of caliche cemented with silica, but containing many cracks and fractures (Ref. 14, pp. 3, 10) that allow water to recharge the Trinity Group. The top portion of the Ogallala Formation is layers of caliche formed by the leaching of calcium carbonate and silica from surface soils during the Plio-Pleistocene era. The caliche ranges in thickness from 20 to 35 feet, varies from crumbly to very hard and can be relatively impermeable in local areas. The caliche layer forms the Acaprock® of the Texas High Plains region (Ref. 22, pp. 36-38).

The Ogallala Aquifer will usually yield large amounts of water (Ref. 10, p. 8). However, at the site, the Ogallala and the Trinity aquifers are nearly indistinguishable (Ref. 8, p.73). Recharge to the Trinity Group (Edwards-Trinity aquifer) occurs indirectly by downward percolation or infiltration from the overlying Ogallala (Ref. 10, p. 16). Cross-formational recharge occurs most readily, where saturated sand and gravel beds in the Ogallala Formation abut against, or overlie porous and permeable parts of the Antlers (Ref. 10, p. 23).

The Monahan's Draw located to the south of the site and the Midland Draw located to the east of the site is within the High Plains/Ogallala/Tertiary aquifer system, which can influence the ground water flow direction in the area of the site.

## **Hydrogeologic Stratum: 2**

**Stratum Name:** Edwards-Trinity (Plateau) Aquifer

The Edwards-Trinity aquifer system underlies about 42,000 square miles of west-central Texas in the Edwards Plateau and Trans-Pecos area (Ref. 7, pp. 5, 9). The aquifer is sometimes referred to as the Edwards-Trinity Plateau aquifer (Ref. 7, p. 9). The Edwards-Trinity aquifer is usually hydraulically connected to the Ogallala sediments where both are present (Ref. 8, p. 83). The Edwards-Trinity aquifer is primarily composed of the Trinity Group Sand in the West County Road 112 (site) area that typically consists of white to purple, loosely, consolidated, fine- to coarse grain well-sorted, unfossiliferous, quartz sandstone containing scattered lenses of quartz gravel (Ref. 22, p. 24). The sandstone can be cemented by silica. Lenses of red clay are scattered throughout (sometimes mistaken for the Upper Dockum - Triassic Red Beds) and a coarse conglomerate about 5 to 10 feet thick, consisting of red and black pebbles of chert and other quartz varieties generally occur at the base of the sandstone. In the Midland area, the Trinity Group Sand has been found to be medium to coarse rounded, white sand, locally ferruginous, weathering to a rust color, and

containing white, black, and red pebbles scattered throughout, but particularly abundant at the base (Ref. 22, pp.22-24).

The Trinity Group is primarily composed of sands from the Antlers and Maxim limestones (Ref. 8, p. 18; Ref. 13, p. 4). Permeable sands and gravels, and clays make up the Trinity Group Sands or Antlers Formation. From the northwestern part of the Edwards Plateau, water generally flows southeastward under hydraulic gradients that average about 10 feet/mile (Ref. 25, pp. 34-41). Local exceptions to the regional pattern result from topographic and drainage variations and depressions in the ground water table caused by pumpage. The maximum hydraulic head occurs in northwestern Midland County at about 3,100 feet above sea level. In Midland county, most recharge results from infiltration of precipitation from land surface and most discharge occurs through well withdraw. Water levels in Midland County have dropped 50 feet over last 50 years. Transmissivity values are approximately 5,000 feet<sup>2</sup>/day (Ref. 25, pp. 34-41).

### **Hydrogeologic Stratum: 3**

#### **Stratum Name:** Upper Dockum or Chinle Formation

The Dockum aquifer is located in the vicinity of the Site and extends to the north and to the northwest into New Mexico (Ref. 8, pp. 16-18). The Dockum aquifer consists of up to 700 feet of sand and conglomerate with layers of silt and shale of the Dockum Group (Ref. 8, p. 18).

During the late Triassic time, Paleozoic rocks were eroded from the surrounding high ground and deposited in low-lying fluvial, deltaic, and lacustrine environments as red beds of the Dockum Group. The Upper Dockum Group is comprised of the Trecovas, Santa Rosa, and Chinle formations (Ref. 22, p.19).

The Chinle formation is considered the upper part of the Dockum Group and it underlies the Trinity Group (Edwards-Trinity aquifer) at the West County Road 112 Ground Water site. The upper part of the Dockum contains the largest percentages of siltstone and shale (Ref. 22, pp. 18-19). The thickness of Chinle Formation varies from 175 to 1,800 feet (Ref. 22, p. 19). In Midland County, the Chinle or upper part has been reported to be approximately 600 feet thick and dipping toward the west (Ref. 22, p. 20). The formation consists mainly of brick red to maroon and purple shale (Ref. 22, pp.18-19), and commonly referred to as Ared beds@.

The underlying mudstone sequences in the Dockum Group are considered the lower confining layer to the Edward-Trinity Aquifer in the study area (Ref. 10, p. 18), and do not yield large quantities of water (Ref. 10, p. 8).

### 3.1 Likelihood of Release

#### 3.1.1 Observed Release

An observed release was documented to the ground water pathway for the site by chemical analysis. To establish an observed release by chemical analysis, it requires analytical evidence of a hazardous substance in the media significantly above the background level. If the background concentration is not detected, or is less than the detection limit, an observed release is established when the sample quantitation limit equals or exceeds its own sample quantitation limit and that of the background sample (Ref. 1, Section 2.3, Table 2-3).

#### **Background Concentration**

Regional ground water flow through the Antlers Formation of the [Edward Trinity aquifer] is generally to the east-southeast in conformance with regional structure and dips (Ref. 10, p. 18; Ref. 7, p 44). Another factor that influences ground water flow movement through the Antlers Formation [Edward-Trinity aquifer] are eroded channels cut into the late Triassic Formation [Dockum] (Ref. 10, p. 18). Two background samples were collected outside of the plume area and up-gradient to the Site based on regional ground water flow conditions (Ref. 10, p. 18; Ref. 7, p 44). These samples were collected in drinking water wells at depths similar to the depths of drinking water wells at the Site. Not all of the depths for the water wells are specified due to lack of information; however, according to residents and local well drillers, the common drilling practice in the area is to install wells within the Edwards/Trinity Formation to a maximum depth of approximately 100 feet bgs (Ref. 111, pp. 1-2). Thus, the background and release samples are likely from the same aquifer and have the same sample similarity. All samples were collected according to the EPA-approved state Quality Assurance Project Plan (QAPP) and sample locations were approved by the EPA (Ref. 112). Table 5 provides a summary of the background ground water samples collected. Table 6 provides a summary of the designated background levels for the hazardous substances of concern for this site.

<b>Table 5: Background Ground Water Samples Collected</b>				
<b>Sample ID*</b>	<b>Sample Location</b>	<b>Well Depth (feet)</b>	<b>Date Collected</b>	<b>Reference</b>
GW-10	Drinking water well located at 3000 W I-20	90 (Ref. 110, p. 3)	7/20/2009	Ref. 6, p. 2
GW-160			6/11/2009	Ref. 17, pp. 89-91
GW-22	Drinking water well located at 3004 S CR 1207	68 (Ref. 90, p. 20)	7/20/2009	Ref. 6, p. 1
GW-066			5/13/2009	Ref. 12, p. 12

\* Background sample locations have multiple Sample IDs. The multiple Sample IDs correspond to the same sample location. The multiple Sample ID numbers were due to use of different Sample IDs during different sampling events at these sampling locations.

<b>Table 6: Summary of Highest Constituents Detected in the Background Ground Water Wells</b>				
<b>Sample ID</b>	<b>Organic Constituent</b>	<b>Highest Concentration [SQL] µg/L*</b>	<b>3 x Highest Background Concentration</b>	<b>Reference</b>
GW-10	Chromium	ND [10] <sup>+</sup>	NA	Ref. 6, p. 2; Ref. 89, pp. 8 & 238
GW-160	Chromium VI	ND [0.01 mg/L] <sup>-</sup>	NA	Ref. 17, pp. 89-91; Ref. 38, pp. 6 & 16; Ref. 74, p. 5
GW-22	Chromium	ND [10] <sup>+</sup>	NA	Ref. 6, p. 1; Ref. 89, pp. 20 & 238
GW-066	Chromium VI	ND [0.01 mg/L] <sup>-</sup>	NA	Ref. 12, p. 12; Ref. 29, pp. 29 & 114; Ref. 29, p. 29

Notes:

ND = Not Detected at the SQL.

[SQL] = Sample Quantitation Limit.

NA = Not applicable.

+ = Reported as Reporting Limit by Region 6 Laboratory.

- = Reported as MQL UnAdj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

Given that all of the background samples have no detected chromium or chromium VI, the background level is ND [10 µg/L] and ND [0.01 mg/L] respectively.

### Contaminated Samples

The samples in Table 7 through Table 11 meet the observed release criteria and are presented below indicating hazardous substances with their concentrations and SQLs. These samples were qualified as “releases” based on the criteria in HRS Table 2-3 (Ref. 1, Section 2.3).

<b>Table 7: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (May 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL<sup>-</sup> (mg/L)*</b>	<b>Reference</b>
GW-011-A	Chromium VI	1.04	0.05	Ref. 27, pp. 20 & 75; Ref. 64, p. 31
GW-020-A	Chromium VI	0.435	0.01	Ref. 27, pp. 26 & 75; Ref. 64, p. 37
GW-048-A	Chromium VI	0.621	0.01	Ref. 27, pp. 5 & 75; Ref. 64, p. 12
GW-049-A	Chromium VI	1.24	0.05	Ref. 27, pp. 15 & 75; Ref. 64, p. 25
GW-050-A	Chromium VI	1.21	0.05	Ref. 27, pp. 10 & 75; Ref. 64, p. 18
GW-023-A	Chromium VI	1.12	0.05	Ref. 28, pp. 16 & 112; Ref. 65, p. 26
GW-042-A	Chromium VI	4.02	0.5	Ref. 28, pp. 55 & 114; Ref. 65, p. 65
GW-043-A	Chromium VI	0.519	0.01	Ref. 28, pp. 6 & 112; Ref. 65, p. 14

<b>Table 7: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (May 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL (mg/L)*</b>	<b>Reference</b>
GW-044-A	Chromium VI	1.81	0.05	Ref. 28, pp. 32 & 113; Ref. 65, p. 39
GW-045-A	Chromium VI	1.23	0.05	Ref. 28, pp. 57 & 114; Ref. 65, p. 72
GW-046	Chromium VI	0.929	0.05	Ref. 28, pp. 22 & 112; Ref. 65, p. 32
GW-047	Chromium VI	4.56	0.5	Ref. 28, pp. 39 & 113; Ref. 65, p. 46
GW-057	Chromium VI	0.026	0.01	Ref. 29, pp. 19 & 114; Ref. 66, p. 30
GW-058	Chromium VI	0.052	0.01	Ref. 29, pp. 69 & 115; Ref. 66, pp. 92
GW-064	Chromium VI	0.041	0.01	Ref. 29, pp. 54 & 115; Ref. 66, pp. 74
GW-083	Chromium VI	0.02	0.01	Ref. 29, pp. 74 & 115; Ref. 66, p. 98
GW-081	Chromium VI	0.322	0.01	Ref. 30, pp. 54 & 102; Ref. 67, p. 74
GW-082	Chromium VI	0.017	0.01	Ref. 30, pp. 49 & 102; Ref. 67, p. 68
GW-086	Chromium VI	1.42	0.05	Ref. 30, pp. 29 & 101; Ref. 67, p. 42
GW-091-A	Chromium VI	0.291	0.01	Ref. 31, pp. 4 & 29; Ref. 68, p. 7
GW-092-A	Chromium VI	0.437	0.01	Ref. 31, pp. 6 & 29; Ref. 68, p. 7
GW-093-A	Chromium VI	0.109	0.01	Ref. 31, pp. 7 & 29; Ref. 68, p. 7
GW-095-A	Chromium VI	0.202	0.01	Ref. 31, pp. 5 & 29; Ref. 68, p. 7
GW-096-A	Chromium VI	0.223	0.01	Ref. 31, pp. 11 & 31; Ref. 68, p. 9
GW-097-A	Chromium VI	0.207	0.01	Ref. 31, pp. 8 & 30; Ref. 68, p. 8
GW-099-A	Chromium VI	0.294	0.01	Ref. 31, pp. 10 & 30; Ref. 68, p. 8
GW-100-A	Chromium VI	2.34	0.05	Ref. 31, pp. 12 & 31; Ref. 68, p. 9
GW-101-A	Chromium VI	1.51	0.05	Ref. 31, pp. 9 & 30; Ref. 68, p. 8
GW-125-A	Chromium VI	0.838	0.05	Ref. 31, pp. 13 & 31; Ref. 68, p. 9
GW-090-A	Chromium VI	0.481	0.01	Ref. 32, pp. 4 & 24; Ref. 69, p. 7
GW-102-A	Chromium VI	0.197	0.01	Ref. 32, pp. 7 & 25; Ref. 69, p. 7
GW-103-A	Chromium VI	0.638	0.05	Ref. 32, pp. 5 & 24; Ref. 69, p. 7
GW-105-A	Chromium VI	0.132	0.01	Ref. 32, pp. 6 & 24; Ref. 69, p. 7
GW-107	Chromium VI	0.03	0.01	Ref. 32, pp. 7 & 24; Ref. 69, p. 7

<b>Table 7: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (May 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL<sup>-</sup> (mg/L)*</b>	<b>Reference</b>
GW-108	Chromium VI	0.151	0.01	Ref. 32, pp. 6 & 24; Ref. 69, p. 7
GW-126	Chromium VI	0.115	0.01	Ref. 32, pp. 8 & 25; Ref. 69, p. 8
GW-127	Chromium VI	0.42	0.01	Ref. 32, pp. 8 & 25; Ref. 69, p. 8
GW-098 A	Chromium VI	0.053	0.01	Ref. 34, pp. 7 & 23; Ref. 70, p. 7
GW-104	Chromium VI	0.448	0.01	Ref. 34, pp. 6 & 23; Ref. 70, p. 7

Note:

- = Reported as MDL UnAdj. or MQL Adj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

<b>Table 8: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (June 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL<sup>-</sup> (mg/L)*</b>	<b>Reference</b>
GW-137-A	Chromium VI	1.1	0.05	Ref. 35, pp. 8 & 21; Ref. 71, p. 5
GW-135-A	Chromium VI	0.473	0.01	Ref. 35, pp. 5-6 & 20; Ref. 71, p. 5
GW-138-A	Chromium VI	1.12	0.05	Ref. 35, pp. 7 & 21; Ref. 71, p. 5
GW-139-A	Chromium VI	2.11	0.05	Ref. 35, pp. 9 & 21; Ref. 71, p. 6
GW-136-A	Chromium VI	0.605	0.01	Ref. 35, pp. 5 & 20; Ref. 71, p. 5
GW-140-A	Chromium VI	1.5	0.05	Ref. 35, pp. 10 & 21; Ref. 71, p. 5-6
GW-141-A	Chromium VI	1.54	0.05	Ref. 35, pp. 4 & 19; Ref. 71, p. 5
GW-142-A	Chromium VI	1.57	0.05	Ref. 35, pp. 6 & 20; Ref. 71, p. 5
GW-143-A	Chromium VI	4.91	0.1	Ref. 35, pp. 9 & 21; Ref. 71, p. 6
GW-144-A	Chromium VI	1.19	0.05	Ref. 35, pp. 7 & 20; Ref. 71, p. 5
GW-145-A	Chromium VI	1.29	0.05	Ref. 35, pp. 4 & 19; Ref. 71, p. 5
GW-146-A	Chromium VI	0.271	0.01	Ref. 35, pp. 7 & 20; Ref. 71, p. 5
GW-029-A	Chromium VI	0.027	0.01	Ref. 36, pp. 7 & 16; Ref. 72, p. 5
GW-090-A	Chromium VI	0.455	0.01	Ref. 36, pp. 4-5 & 15; Ref. 72, p. 5
GW-092-A	Chromium VI	0.472	0.01	Ref. 36, pp. 6 & 16; Ref. 72, p. 5

<b>Table 8: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (June 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL* (mg/L)</b>	<b>Reference</b>
GW-093-A	Chromium VI	0.18	0.01	Ref. 36, pp. 6 & 16; Ref. 72, p. 5
GW-098-A	Chromium VI	0.057	0.01	Ref. 36, pp. 6 & 15-16; Ref. 72, p. 5
GW-150	Chromium VI	0.12	0.01	Ref. 36, pp. 4 & 15; Ref. 72, p. 5
GW-151	Chromium VI	0.068	0.01	Ref. 36, pp. 4 & 15; Ref. 72, p. 5
GW-153	Chromium VI	0.307	0.01	Ref. 36, pp. 5 & 15; Ref. 72, p. 5
GW-091-A	Chromium VI	0.302	0.01	Ref. 37, pp. 7 & 19; Ref. 73, p. 5
GW-095-A	Chromium VI	0.195	0.01	Ref. 37, pp. 6 & 19; Ref. 73, p. 5
GW-096-A	Chromium VI	0.238	0.01	Ref. 37, pp. 7 & 19; Ref. 73, p. 5
GW-097-A	Chromium VI	0.18	0.01	Ref. 37, pp. 7 & 19; Ref. 73, p. 5
GW-099-A	Chromium VI	0.302	0.01	Ref. 37, pp. 5 & 18; Ref. 73, p. 5
GW-100-A	Chromium VI	2.24	0.05	Ref. 37, pp. 4 & 18; Ref. 73, p. 5
GW-101-A	Chromium VI	1.62	0.05	Ref. 37, p. 8; Ref. 73, p. 6
GW-102-A	Chromium VI	0.193	0.01	Ref. 37, p. 6 & 18; Ref. 73, p. 5
GW-103-A	Chromium VI	0.663	0.01	Ref. 37, pp. 5 & 18; Ref. 73, p. 5
GW-104-A	Chromium VI	0.441	0.01	Ref. 37, pp. 9 & 20; Ref. 73, p. 6
GW-125-A	Chromium VI	0.695	0.01	Ref. 37, pp. 4 & 18; Ref. 73, p. 5
GW-080-A	Chromium VI	0.049	0.01	Ref. 38, pp. 4 & 15; Ref. 74, p. 5
GW-081-A	Chromium VI	0.31	0.01	Ref. 38, pp. 4 & 15; Ref. 74, p. 5
GW-086-A	Chromium VI	1.71	0.05	Ref. 38, pp. 5 & 15; Ref. 74, p. 5
GW-105-A	Chromium VI	0.096	0.01	Ref. 38, pp. 5 & 15; Ref. 74, p. 5
GW-126-A	Chromium VI	0.1	0.01	Ref. 38, pp. 6 & 15-16; Ref. 74, p. 5
GW-161	Chromium VI	0.025	0.01	Ref. 38, pp. 7 & 16; Ref. 74, p. 5
GW-108-A	Chromium VI	0.117	0.005	Ref. 40, pp. 6 & 15; Ref. 75, p. 6
GW-176	Chromium VI	0.086	0.005	Ref. 41, pp. 6 & 15; Ref. 76, p. 5
GW-181	Chromium VI	0.034	0.005	Ref. 43, pp. 6 & 15; Ref. 77, p. 5
GW-187	Chromium VI	0.08	0.005	Ref. 43, pp. 6 & 15; Ref. 77, p. 5
GW-192	Chromium VI	0.032	0.005	Ref. 43, pp. 4 & 14; Ref. 77, p. 5
GW-194	Chromium VI	0.014	0.005	Ref. 43, pp. 5 & 14; Ref. 77, pp. 5
GW-196	Chromium VI	0.012	0.005	Ref. 43, pp. 5 & 14; Ref. 77, pp. 5

<b>Table 8: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (June 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL (mg/L)*</b>	<b>Reference</b>
GW-197	Chromium VI	0.031	0.005	Ref. 43, pp. 4 & 14; Ref. 77, pp. 5
GW-254-A	Chromium VI	0.447	0.005	Ref. 45, p. 7; Ref. 78, p. 5-9; Ref. 95, pp. 8 & 22
GW-259	Chromium VI	0.036	0.005	Ref. 19, pp. 23-25; Ref. 48, pp. 4 & 11; Ref. 78, p. 8
GW-005	Chromium VI	0.051	0.005	Ref. 49, pp. 9 & 25; Ref. 64, p. 12-50
GW-104	Chromium VI	0.437	0.005	Ref. 37, pp. 9 & 20; Ref. 73, pp. 5-6

Note:

- = Reported as MDL UnAdj. or MQL Adj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

<b>Table 9: Contaminated Ground Water Pathway Drinking Water Samples Meeting Observed Release Criteria (July 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL (mg/L)*</b>	<b>Reference</b>
GW-029	Chromium VI	0.023	0.005	Ref. 50, pp. 4 & 15; Ref. 80, pp. 5-6
GW-036	Chromium VI	0.013	0.005	Ref. 50, pp. 4 & 15; Ref. 80, pp. 5-6
GW-038	Chromium VI	0.031	0.005	Ref. 50, pp. 5 & 15; Ref. 80, pp. 5-6
GW-053	Chromium VI	0.018	0.005	Ref. 50, pp. 8 & 16; Ref. 80, pp. 5-6
GW-057	Chromium VI	0.027	0.005	Ref. 50, pp. 5 & 15; Ref. 80, pp. 5-6
GW-058-A	Chromium VI	0.051	0.005	Ref. 50, pp. 6 & 16; Ref. 80, pp. 5-6
GW-064	Chromium VI	0.088	0.005	Ref. 50, pp. 6 & 16; Ref. 80, pp. 5-6
GW-071	Chromium VI	0.008	0.005	Ref. 50, pp. 7 & 16; Ref. 80, pp. 5-6
GW-082	Chromium VI	0.018	0.005	Ref. 50, pp. 7 & 16; Ref. 80, pp. 5-6
GW-107	Chromium VI	0.035	0.005	Ref. 50, pp. 7 & 16; Ref. 80, pp. 5-6
GW-150-A	Chromium VI	0.124	0.005	Ref. 50, pp. 5 & 15; Ref. 80, p. 5
GW-261	Chromium VI	0.136	0.005	Ref. 51, pp. 4 & 11; Ref. 80, p. 5
GW-104-A	Chromium VI	0.442	0.05	Ref. 58, pp. 5 & 16; Ref. 84, p. 5-6
GW-150	Chromium VI	0.121	0.01	Ref. 58, pp. 5 & 16; Ref. 84, pp. 5-6
GW-132	Chromium VI	0.012	0.005	Ref. 62, pp. 4 & 11; Ref. 86, p. 5

Note:

- = Reported as MQL UnAdj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

<b>Table 10: Contaminated Ground Water Pathway Drinking Water Samples meeting Observed Release Criteria (July 2009 SI Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (µg/L)</b>	<b>SQL<sup>+</sup> (µg/L)*</b>	<b>Reference</b>
GW-20	Chromium	497	10	Ref. 88, pp. 5-6; Ref. 89, pp. 16 & 238
GW-19	Chromium	1010	10	Ref. 88, p. 5; Ref. 89, pp. 12 & 238
GW-28	Chromium	1040	10	Ref. 88, p. 6; Ref. 89, pp. 30 & 238
GW-27	Chromium	694	10	Ref. 88, p. 6; Ref. 89, pp. 26 & 238
GW-14	Chromium	4450	10	Ref. 88, p. 5; Ref. 89, pp. 38 & 240
GW-21	Chromium	1400	10	Ref. 88, p. 6; Ref. 89, pp. 42 & 240
GW-31	Chromium	3780	10	Ref. 88, p. 6; Ref. 89, pp. 50 & 240
GW-29	Chromium	1400	10	Ref. 88, p. 6; Ref. 89, pp. 46 & 240
GW-07	Chromium	110	10	Ref. 88, p. 5; Ref. 89, pp. 66 & 242
GW-13	Chromium	530	10	Ref. 88, p. 5; Ref. 89, pp. 74 & 242
GW-12	Chromium	191	10	Ref. 88, p. 5; Ref. 89, pp. 70 & 242
GW-08	Chromium	350	10	Ref. 88, p. 15; Ref. 89, pp. 94 & 244
GW-05	Chromium	217	10	Ref. 88, p. 5; Ref. 89, pp. 62 & 242
GW-03	Chromium	2510	10	Ref. 88, p. 5; Ref. 89, pp. 54 & 242
GW-04	Chromium	1980	10	Ref. 88, p. 5; Ref. 89, pp. 58 & 242
GW-16	Chromium	440	10	Ref. 88, p. 5; Ref. 89, pp. 102 & 244
GW-02	Chromium	239	10	Ref. 88, p. 5; Ref. 89, pp. 90 & 244
GW-09	Chromium	375	10	Ref. 88, p. 5; Ref. 89, pp. 98 & 244
GW-01	Chromium	431	10	Ref. 88, p. 5; Ref. 89, pp. 86 & 244
GW-11	Chromium	466	10	Ref. 88, p. 5; Ref. 89, pp. 128 & 247
GW-06	Chromium	116	10	Ref. 88, p. 5; Ref. 89, pp. 124 & 247
GW-17	Chromium	47.3	10	Ref. 88, p. 5; Ref. 89, pp. 132 & 247
GW-18	Chromium	313	10	Ref. 88, p. 5; Ref. 89, pp. 136 & 247
GW-15	Chromium	107	10	Ref. 88, p. 5; Ref. 89, pp. 112 & 246
GW-34	Chromium	491	10	Ref. 88, p. 5; Ref. 89, pp. 120 & 246
GW-25	Chromium	1140	10	Ref. 88, p. 6; Ref. 89, pp. 116 & 246

Note:

+ = Reported as Reporting Limit by Region 6 Laboratory.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

<b>Table 11: Contaminated Ground Water Pathway Drinking Water Samples meeting Observed Release Criteria (September 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL<sup>+</sup> (mg/L)*</b>	<b>Reference</b>
GW-104	Chromium	0.422	0.05	Ref. 98, pp. 4 & 16; Ref. 45, p. 21; Ref. 42, p. 8
GW-020	Chromium	0.508	0.05	Ref. 94, pp. 5 & 20; Ref. 45, p. 21; Ref. 42, p. 8
GW-023	Chromium	1.01	0.05	Ref. 94, pp. 6 & 20-21; Ref. 45, p. 22; Ref. 42, p. 8
GW-042-A	Chromium	3.62	0.05	Ref. 94, pp. 8 & 21; Ref. 45, p. 22; Ref. 42, p. 9
GW-043-A	Chromium	0.668	0.05	Ref. 93, pp. 6 & 20; Ref. 45, p. 20; Ref. 42, p. 7
GW-044-A	Chromium	1.71	0.05	Ref. 93, pp. 5 & 20; Ref. 45, p. 20; Ref. 42, p. 7
GW-045-A	Chromium	1.5	0.05	Ref. 93, pp. 9 & 22; Ref. 45, p. 21; Ref. 42, p. 8
GW-046-A	Chromium	1.11	0.05	Ref. 93, pp. 7, 20, & 22; Ref. 45, p. 20; Ref. 42, p. 7
GW-048-A	Chromium	0.572	0.05	Ref. 95, pp. 10 & 22; Ref. 45, p. 23; Ref. 42, p. 10
GW-049	Chromium	1.01	0.05	Ref. 95, pp. 5 & 21; Ref. 45, p. 23; Ref. 42, p. 9
GW-050-A	Chromium	1.04	0.05	Ref. 95, pp. 6 & 21; Ref. 45, p. 23; Ref. 42, p. 9
GW-080-A	Chromium	0.097	0.05	Ref. 93, pp. 7 & 21; Ref. 45, p. 21; Ref. 42, p. 7
GW-090-A	Chromium	0.419	0.05	Ref. 95, pp. 9 & 22; Ref. 45, p. 23; Ref. 42, p. 10
GW-091-A	Chromium	0.335	0.05	Ref. 93, pp. 10 & 22; Ref. 45, p. 21; Ref. 42, p. 8
GW-092-A	Chromium	0.537	0.05	Ref. 94, pp. 9 & 21; Ref. 45, p. 22; Ref. 42, p. 9
GW-093-A	Chromium	0.211	0.05	Ref. 94, pp. 10 & 21-22; Ref. 45, p. 22; Ref. 42, p. 9
GW-094-A	Chromium	0.127	0.05	Ref. 94, pp. 11 & 22; Ref. 45, p. 22; Ref. 42, p. 9
GW-095-A	Chromium	0.21	0.05	Ref. 95, pp. 7 & 21; Ref. 45, p. 23; Ref. 42, p. 10
GW-096-A	Chromium	0.273	0.05	Ref. 93, pp. 11 & 22; Ref. 45, p. 21; Ref. 42, p. 8
GW-097-A	Chromium	0.272	0.05	Ref. 95, pp. 4 & 20; Ref. 45, p. 22; Ref. 42, p. 9

<b>Table 11: Contaminated Ground Water Pathway Drinking Water Samples meeting Observed Release Criteria (September 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. (mg/L)</b>	<b>SQL (mg/L)*</b>	<b>Reference</b>
GW-254-A	Chromium	0.447	0.05	Ref. 95, pp. 8 & 22; Ref. 45, p. 23; Ref. 42, p. 10
GW-019-A	Chromium	0.17	0.05	Ref. 97, pp. 6 & 17; Ref. 45, p. 25; Ref. 42, p. 11
GW-081-A	Chromium	0.267	0.05	Ref. 97, pp. 7 & 17-18; Ref. 45, p. 25; Ref. 42, p. 12
GW-086-A	Chromium	1.59	0.05	Ref. 97, pp. 8 & 18; Ref. 45, pp. 25; Ref. 42, p. 12
GW-099	Chromium	0.317	0.05	Ref. 45, p. 24; Ref. 42, p. 11
GW-100-A	Chromium	1.96	0.05	Ref. 96, pp. 4 & 19; Ref. 45, p. 23; Ref. 42, p. 10
GW-101-A	Chromium	1.94	0.05	Ref. 96, pp. 5 & 19; Ref. 45, p. 24; Ref. 42, p. 10
GW-102-A	Chromium	0.27	0.05	Ref. 98, pp. 6 & 16; Ref. 45, p. 26; Ref. 42, p. 12
GW-103-A	Chromium	0.619	0.05	Ref. 98, pp. 6 & 16; Ref. 45, p. 26; Ref. 42, p. 12
GW-104-A	Chromium	0.422	0.05	Ref. 98, pp. 4 & 16; Ref. 45, p. 25; Ref. 42, p. 12
GW-105-A	Chromium	0.088	0.05	Ref. 96, pp. 10 & 20; Ref. 45, p. 24; Ref. 42, p. 11
GW-126-A	Chromium	0.111	0.05	Ref. 97, pp. 4 & 17; Ref. 45, p. 24; Ref. 42, p. 11
GW-146-A	Chromium	0.241	0.05	Ref. 96, pp. 7 & 20; Ref. 45, p. 24; Ref. 42, p. 11
GW-098-A	Chromium	0.098	0.05	Ref. 99, pp. 5 & 20; Ref. 45, p. 26; Ref. 42, p. 13
GW-047-A	Chromium	4.51	0.05	Ref. 100, pp. 5 & 23; Ref. 45, p. 27; Ref. 42, p. 13
GW-064	Chromium	0.097	0.05	Ref. 100, pp. 8 & 24; Ref. 45, p. 27; Ref. 42, p. 14
GW-108-A	Chromium	0.129	0.05	Ref. 100, pp. 4 & 23; Ref. 45, p. 27; Ref. 42, p. 13
GW-187	Chromium	0.101	0.05	Ref. 45, p. 27; Ref. 42, p. 14; Ref. 100, pp. 10 & 25
GW-150-A	Chromium	0.158	0.05	Ref. 101, pp. 5 & 24-25 ; Ref. 45, p. 28; Ref. 42, p. 15
GW-176	Chromium	0.107	0.05	Ref. 59, pp. 4 & 12; Ref. 45, p. 30; Ref. 42, p. 16

Note:

- = Reported as MDL UnAdj. or MQL Adj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

<b>Table 12: Contaminated Ground Water Pathway Drinking Water Samples meeting Observed Release Criteria (November 2009 Results)</b>				
<b>Sample Location</b>	<b>Contaminant Detected</b>	<b>Conc. mg/L</b>	<b>SQL mg/L*</b>	<b>Reference</b>
GW-151	Chromium	0.073	0.05	Ref. 44, p. 3; Ref. 46, p. 4 ; Ref. 55, pp. 8 & 25
GW-299	Chromium	0.161	0.05	Ref. 44, p. 4; Ref. 46, p. 4-5; Ref. 55, pp. 13 & 26
GW-313	Chromium	0.076	0.05	Ref. 44, p. 3; Ref. 46, p. 4-5; Ref. 55, pp. 11 & 26
GW-058	Chromium	0.053	0.05	Ref. 44, p. 5; Ref. 46, p. 6; Ref. 57, pp. 6 & 19

Note:

- = Reported as MDL UnAdj. or MQL Adj. by Xenco Laboratories.

\* For all of the analyses the reporting limit in the references cited is the SQL based on the method detection limit (Ref. 134).

### **Attribution**

The site is designated as a contaminated ground water plume originating from unknown source(s) where chromium and chromium VI may have been released and percolated through the ground to the aquifer. When the source itself consists of a ground water plume with no identified source, no separate attribution is required (Ref.1, Sec. 3.1.1).

### **Hazardous Substances Released**

The following hazardous substances were released:  
Chromium and chromium VI.

As specified in the HRS (Ref. 1, Section 3.1.1), an observed release factor value of 550 was assigned to the Edwards-Trinity aquifer since an observed release by chemical analysis was established in the Edwards-Trinity aquifer.

<b>Observed Release Factor Value: 550</b>
---

### **3.1.2 Potential to Release**

As specified in the HRS, since an observed release was established for the Edwards-Trinity aquifer, the potential to release was not evaluated (Ref. 1, Section 3.1.1).

### **3.1.3 Likelihood of Release Factor Category Value**

As stated in the HRS, if an observed release is established for an aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for the aquifer (Ref. 1, Section 3.1.3). Since an observed release has been established for the aquifer, the Observed Release Factor Value of 550 is assigned as the likelihood of release factor category value.

## **3.2 Waste Characteristics**

### **3.2.1 Toxicity/Mobility**

The hazardous substances with the highest toxicity factor value available to the ground water migration pathway are chromium and chromium VI, which both have a toxicity/mobility value of 10,000. Therefore, the following toxicity, mobility, and combined toxicity/mobility factor value has been assigned to the substances associated with Source No. 1, or present in the observed release, which has a containment value greater than 0.

<b>Table 13: Toxicity/Mobility Factor Values</b>				
<b>Hazardous Substance</b>	<b>Toxicity Factor Value</b>	<b>Mobility Factor Value</b>	<b>Toxicity / Mobility Value</b>	<b>Reference</b>
Chromium	10,000	1	10,000	Ref. 1, Sections 2.4.1.2, 3.2.1; Ref. 3, pp. 1-3
Chromium VI	10,000	1	10,000	Ref. 1, Sections 2.4.1.2, 3.2.1; Ref. 3, pp. 1-3

### **Documentation for Toxicity/Mobility Values**

The Mobility Factor Value for all hazardous substances that meet the criteria for an observed release by chemical analysis to one or more aquifers underlying the source(s) at the Site, regardless of the aquifer being evaluated, is assigned a mobility factor value of 1 (Ref. 1, Section 3.2.1.2).

Therefore, the hazardous substance with the highest toxicity/mobility factor value available to the ground water migration pathway is both chromium and chromium VI with a combined toxicity/mobility factor value of 10,000.

**Toxicity/Mobility Factor Value: 10,000**

### 3.2.2 Hazardous Waste Quantity

According to Section 2.4.2.2 of the HRS, a pathway hazardous waste quantity factor value of 100 was assigned because the hazardous constituent quantity data is not adequately determined for one or more sources, and targets for the Ground Water Migration Pathway are subject to Level I concentrations (Ref. 1, Section 2.4.2.2).

<b>Table 14: Source Hazardous Waste Quantity Values</b>		
<b>Source Number</b>	<b>Source Hazardous Waste Quantity Value</b>	<b>Hazardous Constituent Quantity Data Complete?</b>
1	> 0	NO
Total	> 0	

### 3.2.3 Waste Characteristics Factor Category Value

As specified in the HRS (Ref. 1, Section 3.2.3), the Hazardous Waste Quantity Factor Value of 100 was multiplied by the highest Toxicity/Mobility Factor Value of 10,000, resulting in a product of 1,000,000 (1.0E+06). Based on this product, a Waste Characteristics Factor Value of 32 was assigned from Table 2-7 of the HRS (Ref. 1, Section 2.4.3.1).

**Hazardous Waste Quantity Factor Value: 100**

**Waste Characteristics Factor Value: 32**

### 3.3 Ground water Pathway Targets

The primary aquifer being evaluated for the ground water pathway targets is the Edwards-Trinity aquifer. The ground water pathway targets for this aquifer have been impacted with chromium and chromium VI above a human health based benchmark. The number of target wells subject to Level I concentration of chromium, which is the concentration above a benchmark, is given in Table 15. The population served is also given in Table 15. The average population per household of 2.62, which was determined from 2000 census when the population size of Midland was 94,996 (Ref. 15, p. 1), has been applied where the population size was not available from the water well survey. The 2008 estimated population in Midland is 104,768 (Ref. 15, p. 9).

Table 15: Drinking Water Wells with Level I Concentration of Chromium						
Well ID	Chromium Conc. $\mu\text{g/L}$ (mg/L)	Benchmarks/Screening Concentrations (Ref. 3, pp. 1-3)			Population Served	Reference
		MCL / MCLG $\mu\text{g/L}$ (mg/L)	Cancer Risk Screen. Conc. $\mu\text{g/L}$ (mg/L)	Ref. Dose Screen. Conc. $\mu\text{g/L}$ (mg/L)		
GW-08	350	100 (0.1)	NA	110 (0.11)	2	Ref. 5, p. 23-24; Ref. 88, p. 5; Ref. 89, pp. 94 & 244
GW-11	466				2.62	Ref. 19, p. 87; Ref. 88, pp. 5 & 15; Ref. 84, pp. 5-7; Ref. 89, pp. 128 & 247
GW-12	191				4	Ref. 5, pp. 21- 22; Ref. 88, p. 5; Ref. 89, pp. 70 & 242
GW-13	530				2.62	Ref. 6, p. 15; Ref. 88, p. 5; Ref. 89, pp. 74 & 242
GW-14	4,450				2.62	Ref. 5, p. 11-12; Ref. 88, p. 5; Ref. 89, pp. 38 & 240
GW-15	107				6	Ref. 5, pp. 37-38; Ref. 88, p. 5; Ref. 89, pp. 112 & 246
GW-19	1,010				2.62	Ref. 6, p. 3; Ref. 88, p. 5; Ref. 89, pp. 12 & 238
GW-20	497				2.62	Ref. 5, pp. 7-8; Ref. 88, p. 5; Ref. 89, pp. 16 & 238
GW-21	1,400				2.62	Ref. 6, p. 5; Ref. 88, p. 6; Ref. 89, pp. 42 & 240
GW-27	694				2	Ref. 6, p. 4; Ref. 88, p. 6; Ref. 89, pp. 20 & 238
GW-28	1,040				2.62	Ref. 5, pp. 9-10; Ref. 88, p. 6; Ref. 89, pp. 30 & 238
GW-29	1,400				2.62	Ref. 6, pp. 5; Ref. 88, p. 5; Ref. 89, pp. 46 & 240
GW-31	3,780				2.62	Ref. 5, pp. 13-14; Ref. 88, p. 6; Ref. 89, pp. 50 & 240
GW-34	491				2.62	Ref. 5, pp. 39-40; Ref. 88, pp. 1-10; Ref. 89, pp. 120 & 246
GW-099-A	(0.317)				2.62	Ref. 26, p. 19; Ref. 45, p. 24; Ref. 42, p. 11; Ref. 96, pp. 6 & 19

Table 15: Drinking Water Wells with Level I Concentration of Chromium						
Well ID	Chromium Conc. µg/L (mg/L)	Benchmarks/Screening Concentrations (Ref. 3, pp. 1-3)			Population Served	Reference
		MCL / MCLG µg/L (mg/L)	Cancer Risk Screen. Conc. µg/L (mg/L)	Ref. Dose Screen. Conc. µg/L (mg/L)		
GW-102-A	(0.27)	100 (0.1)	NA	110 (0.11)	2.62	Ref. 21, p. 41; Ref. 98, pp. 6 & 16; Ref. 45, p. 26; Ref. 42, pp. 6-18
GW-103-A	(0.619)				2.62	Ref. 21, p. 43; Ref. 98, pp. 6 & 16; Ref. 45, p. 26; Ref. 42, p. 12
GW-150-A	(0.158)				2.62	Ref. 21, pp. 75-77; Ref. 101, pp. 5 & 24; Ref. 45, pp. 19-31; Ref. 42, p. 15
Total Population Served					50.68	

NA= Not available.

The numbers of targets for Level I concentration of chromium VI are given in Table 16. Those targets with Level I concentration of chromium VI that have already been accounted for in Level I concentration of chromium have not been considered. The population served is also given in the table.

Table 16: Drinking Water Wells with Level I Concentration of Chromium VI						
Well ID	Chromium VI Concentration mg/L	Benchmarks/Screening Concentrations			Population Served	Reference
		MCL / MCLG mg/L	Cancer Risk Screen. Con. mg/L	Ref. Dose Screen. Conc. mg/L		
GW-261	0.136	NA	NA	0.11	2.62	Ref. 18, p. 53; Ref. 51, pp. 4 & 11; Ref. 80, pp. 5-6
Total Population Served					2.62	

NA= Not available

### **3.3.1 Nearest Well**

According to Section 3.3.1 of the HRS, if one or more drinking water wells is subject to Level I concentrations, a Nearest Well Factor value of 50 is assigned. Level I concentrations have been documented in 19 wells within the ground water plume.

Level of Contamination (I, II, or potential): Level I

Location of Well: Level I concentrations have been documented at 19 wells within the ground water plume. Well locations are identified in Table 1.

For a well with Level I concentrations, a Nearest Well Factor Value of 50 is assigned (Ref. 1, Section 3.3.1).

<b>Nearest Well Factor Value: 50</b>
--------------------------------------

### **3.3.2 Population**

#### **3.3.2.1 Level of Contamination**

#### **3.3.2.2 Level I Concentration**

The concentrations of hazardous substance shown in Table 15 and Table 16 include detections in drinking water wells that meet or exceed their corresponding benchmark concentrations; thus, these wells are associated with Level I concentrations (Ref. 1, Section 3.3.2.1-3.3.2.2).

Nineteen private wells within a one-mile radius of the Site contained Level I concentrations of hazardous substances (see Table 15 and Table 16). All the private wells drew water from the Edwards-Trinity Aquifer (Ref. 111, pp.1-2). The residents depend upon their private wells for their daily water needs. TCEQ has installed 45 anion exchange filter systems due to the presence of chromium, as of November 2009 (Ref. 102, pp. 1-3).

As specified in the HRS (Ref. 1, Section 3.3.2.2), the number of people served by drinking water from points of withdrawal subject to Level I concentrations were summed. Using the average population per household of 2.62 (Ref. 15, pp. 1-2) or the population from the water well survey where available, the total population counted from Level I wells is 53.30. The total of 53.30 was multiplied by 10, for a product of 533 (Ref. 1, Section 3.3.2.2).

<b>Level I Concentration Factor Value: 533</b>
--

<b>Population Served by Level I Well: 53.30</b>
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### 3.3.2.3 Level II Concentration

The Level II concentration, which is the concentration above background but below the benchmark, was found in eight wells. As specified in the HRS, the number of people served by drinking water from points of withdrawal subject to Level II concentrations is summed up and the sum is assigned as the value for this factor. Table 17 below gives the list of ground water wells with Level II concentration of chromium. The population served is also given in the table.

Table 17: Drinking Water Well with Level II Concentration of Chromium						
Well ID	Chromium Conc. µg/L (mg/L)	Benchmarks/Screening Concentrations			Population Served	Reference
		MCL / MCLG µg /L (mg/L)	Cancer Risk Screen. Con. µg/L (mg/L)	Ref. Dose Screen. Conc. µg/L (mg/L)		
GW-098	(0.098)	100 (0.1)	NA	110 (0.11)	2	Ref. 21, p. 59; Ref. 99, pp. 5 & 20; Ref. 45, p. 26; Ref. 42, p. 13, Ref. 90, p.29
GW-064	(0.097)				2.62	Ref. 21, p. 71; Ref. 100, pp. 8 & 24; Ref. 45, p. 27; Ref. 42, p. 14
GW-151	(0.073)				17	Ref. 44, p. 3; Ref. 46, p. 4 ; Ref. 55, pp. 8 & 25; Ref. 129, p. 1; Ref. 90, pp. 46-47
GW-058	(0.053)				2.62	Ref. 21, p. 95; Ref. 44, p. 4; Ref. 46, p. 4-6; Ref. 57, pp. 6 & 19
Total Population Served					24.24	

NA= Not available

The number of targets for Level II concentration of chromium VI is given in Table 18. Those targets with Level II concentration of chromium VI, which have already been accounted for in Level II concentration of chromium have not been considered.

<b>Table 18: Drinking Water Well with Level II Concentration of Chromium VI</b>						
Well ID	Chromium Conc. mg/L	Benchmarks/Screening Concentrations			Population Served	Reference
		MCL / MCLG mg/L	Cancer Risk Screen. Con. mg/L	Ref. Dose Screen. Conc. mg/L		
GW-029	0.027	NA	NA	0.11	2.62	Ref. 17, p. 77; Ref. 36, pp. 7 & 16; Ref. 79, p. 95
GW-005	0.051				2.62	Ref. 18, p. 39; Ref. 49, pp. 9 & 25; Ref. 64, p. 12-50
GW-053	0.018				2.62	Ref. 50, pp. 8 & 16; Ref. 80, p. 5

<b>Table 18: Drinking Water Well with Level II Concentration of Chromium VI</b>						
<b>Well ID</b>	<b>Chromium Conc. mg/L</b>	<b>Benchmarks/Screening Concentrations</b>			<b>Population Served</b>	<b>Reference</b>
		<b>MCL / MCLG mg/L</b>	<b>Cancer Risk Screen. Con. mg/L</b>	<b>Ref. Dose Screen. Conc. mg/L</b>		
GW-057	0.027	NA	NA	0.11	2.62	Ref. 18, p. 41; Ref. 50, pp. 5 & 15; Ref. 80, p. 5
<b>Total Population Served</b>					<b>10.48</b>	

NA= Not Available

**Population Served by Level II Well: 34.72**

**Level II Concentration Factor Value: 34.72**

#### **3.3.2.4 Potential Contamination**

The potential contamination factor was evaluated and scored. The ground water wells were identified from the well database in the TCEQ GIS servers and from the Texas Water Development Board (TWDB) (Ref. 109, pp. 1-20). The wells were researched within radii of 0 to 0.5, 0.5 to 1, 1 to 2, 2 to 3, and 3 to 4-miles of the site (see Figures 1c and 1d of this HRS documentation record). Using the average population per household of 2.62 (Ref. 15, p. 1), the potential targets (Table 14) were calculated based on the number of wells located within each distance category and the weighted population assigned from Table 3-12 of the HRS.

##### **0 to 0.25-mile**

The thirty wells located at 0 to 0.25-mile radius from the center of the site were all tested and accounted in Level I or Level II contamination according to the level of contaminants of concern (i.e., chromium and/or chromium VI) detected in those samples (see Tables 1, 15-16 and Figures 1c and 1d of this HRS documentation record).

##### **0.25 to 0.5-mile**

There were 12 domestic wells located at 0.25 to 0.5-mile radius of the site. Among the 12 wells, only seven were considered for potential contamination as the rest were included in Level I or Level II contamination (see Tables 1, 17-18 and Figures 1c and 1d of this HRS documentation record).

##### **0.5 to 1-mile**

At 1 to 0.5 to 1-mile of the site, four domestic ground water wells were located. All of them were considered as potential to contamination domestic wells (see Figures 1c and 1d of this HRS documentation record).

##### **1 to 2-mile**

At 1 to 2-miles of the site, thirty-eight domestic ground water wells were located. Two public water supply (PWS) systems were found: 1) PWS with identification 1650077 with two wells serving a population of 165 (Ref. 120, p. 1); and 2) PWS with identification 1650111 with two serving wells for a population of 147 (Ref. 120, p. 5). Together with 38 domestic wells (see Figures 1c and 1d of this HRS documentation record), the population at 1 to 2-mile is 411.56.

##### **2 to 3-mile**

Within 2 to 3 miles of the site, 42 domestic wells were found. There were four PWS systems located at a 2 to 3-mile radius of the Site, which are described below:

1) The PWS with identification 1650047 with five serving wells (Ref. 120, p.9), of which four wells are within 2 to 3-mile radius. None of the wells contributes more than 40% of the system's total water supply; hence, the population served was equally apportioned to all the wells. Therefore, the total population served by the PWS, three-hundred (300), was divided by the total number of wells, five, giving a product of 60. Because there were four active wells located within 2 to 3-mile radius of this PWS, the population served is 240;

2) The PWS system with identification 1650111 with one well, which is an inactive well, therefore, it was not considered;

3) The PWS with identification 1650057 with two wells serving 234 people (Ref. 120, p. 13); and

4) The PWS with identification 1650084 with six active wells of which five are within 2 to 3-mile radius (Ref. 120, p. 17). None of the wells contribute more than 40% of the system's water. Therefore, the population served, which is 285, was equally apportioned to all six wells, which gives a population of 237.5 for the five wells within 1 to 2 miles.

The total population served by PWS within a 2 to 3-mile radius of the Site is 711.5. Together with the domestic wells, the total population served located within a 1 to 2-mile radius of the Site is 821.54 (see Figures 1c and 1d of this HRS documentation record).

### 3 to 4-mile

There were 33 domestic wells located in a 3 to 4-mile radius of the Site. No PWS were found in a 3 to 4-mile radius of the Site (see Figures 1c and 1d of this HRS documentation record).

As specified in the HRS (Ref. 1, p. 51604), the number of people served by drinking water wells was determined within each 'Other Than Karst' distance category and a distance-weighted population value for each distance category was assigned. The distance weighted population values were summed for a total of 178, which was divided by 10 for a product of 17.8.

<b>Table 19: Potential Contamination</b>				
<b>Distance (Miles)</b>	<b>Potentially Contaminated Domestic Wells</b>	<b>Potentially Contaminated PWS Wells (Well ID)</b>	<b>Potentially Contaminated Population</b>	<b>Weighted Population</b>
0 to 0.25	0	NA	0*	
0.25 to 0.5	7	NA	18.34**	11
0.5 to 1	4	NA	10.48	1
1 to 2	38	2 (ID: 1650077)	411.56	94
		2 (ID: 1650111)		
2 to 3	42	4 (ID: 1650047)	821.54	68
		2 (ID: 1650057)		
		5 (ID: 1650084)		
3 to 4	33	NA	86.46	4
		Total	1,348.38	178

NA= Not applicable

\* All wells within this distance category ring are already accounted for in Level I or II contamination sections of this HRS documentation record.

\*\* Only seven of the 12 wells located in this distance category ring were considered subject to potential contamination as the rest were accounted for in the Level I or II contamination sections of this HRS documentation record.

<b>Potential Contamination Factor Value: 17.8</b>
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### **3.3.3 Resources**

No resources, as defined in HRS Section 3.3.3, were documented for the Edwards-Trinity and Ogallala aquifers (Ref. 1)

<b>Resource Factor Value: 0</b>
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### **3.3.4 Wellhead Protection Area**

The Wellhead Protection Area (WPA) has not been evaluated at this time.

<b>Wellhead Protection Area Factor Value: NS</b>
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### **3.3.5 Calculation of Targets Factor Category Value**

The target factor category value is calculated by determining the sum of the factor values for the nearest well (50), population (533 + 34.72 + 17.8), resources (0), and WPA (0) (Ref. 1, Section 3.3.5).

$$\text{Calculations: } 50 + 585.52 + 0 + 0 = 611.28$$

### **3.4 Ground Water Migration Score for an Aquifer**

The ground water migration score for an aquifer is calculated by multiplying the factor category values for likelihood of release (550), waste characteristics (32), and targets (646). Divided by 82,500, the resulting value (maximum value 100) is assigned as the ground water migration pathway score (Ref. 1, Section 3.4).

$$\text{Calculations: } (550 \times 32 \times 611.28) / 82,500 = 130.41 \text{ (100 maximum)}$$

### **3.5 Calculation of Ground Water Migration Pathway Score**

The ground water migration pathway score is calculated by assigning the highest ground water migration score for the aquifer being evaluated (100).

### 3.5.1 Calculation of HRS Site Score

The HRS site score is calculated by using the root-mean-square equation which squares each pathway score then takes the sum of all pathways and divides the sum by 4 then takes the square root which is the site score (Ref. 1, Section 2.1.1).

Calculations:

#### Pathway Squares

GW Pathway [100] = 10,000

SW Pathway not scored = 0

Soil Pathway not scored = 0

Air Pathway not scored = 0

$$S_{gw} + S_{sw} + S_s + S_a = 10,000 + 0 + 0 + 0 = 10,000$$

$$10,000 / 4 = 2,500$$

$$\sqrt{2,500} = 50.00$$

HRS Site Score: 50.00